

**ENVIRONMENTAL SERVICES
UST REMOVAL - WASTE OIL TANK #5
NAVAL SUBMARINE BASE
GROTON, CONNECTICUT**

PREPARED FOR:
The EADS Group
1126 Eighth Avenue
Altoona, Pennsylvania

PREPARED BY:
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December 1991

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December 13, 1991
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Mr. Edwin Baker
The EADS Group
1126 Eighth Avenue
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Altoona, PA 16603

Re: Environmental Services
UST Removal - Waste Oil Tank #5
Naval Submarine Base - New London
Groton, Connecticut

Dear Mr. Baker:

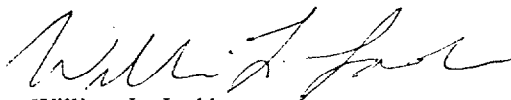
GZA GeoEnvironmental, Inc. (GZA) is pleased to provide you with this report containing our observations and conclusions relating to the apparent environmental conditions at the site of the above-referenced project. As outlined in our proposal dated October 7, 1991, the primary objectives of the study were to (1) perform a topographic survey in the general area of the tank; (2) perform a limited subsurface environmental investigation in the area surrounding Waste Oil Tank #5; and (3) obtain samples of the sludge in Tank #5 for laboratory analysis.

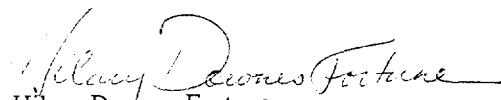
This report has been prepared in accordance with the Limitations and Terms and Conditions set forth in Appendix A. No other warranty, expressed or implied, is made.

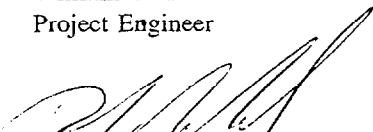
We have appreciated the opportunity to work with you on this project and trust that this report satisfies your current needs. Should you have any questions or comments, please do not hesitate to contact the undersigned.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.


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Project Engineer


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1.00 INTRODUCTION



In accordance with our October 7, 1991 proposal, GZA GeoEnvironmental (GZA) has prepared this report containing our observations and conclusions relating to the apparent environmental conditions at the Waste Oil Tank #5 site. The primary objectives of the study were to (1) perform a topographic survey in the general area of the tank; (2) perform a limited subsurface environmental investigation in the area surrounding Waste Oil Tank #5; and (3) obtain and test samples of the sludge in the tank.

The scope of services as requested by the Navy included:

- a review of record drawings and existing utility data sheets of the work area;
- a topographic survey of the site, covering approximately one acre;
- subsurface explorations, in the form of four shallow test borings around the tank;
- the analysis of selected soil samples from the borings for volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH), petroleum hydrocarbon (PHC) fingerprinting, polychlorinated biphenyls (PCBs) and pesticides by EPA Method 8080, and total metals;
- the collection of two sludge samples from the bottom of the tank for total petroleum hydrocarbon (TPH) analysis, analysis for polychlorinated biphenyls (PCBs) and pesticides by EPA Method 8080, and total metals analysis; and
- the preparation of this report containing an opinion as to the presence of oil or hazardous materials in the soil at the site.

Information obtained during the course of the study revealed that residual waste oil and water, as well as waste oil sludge, was present inside Waste Oil Tank #5. Although not included in our original scope of work, samples of the waste oil were collected and analyzed for TPH, PCBs and pesticides, and VOCs. We felt that this information would be valuable in evaluating disposal options.

The findings of our study are subject to the Limitations contained in Section 6.00 and Appendix A of this report.

2.00 BACKGROUND

The following paragraphs describe the physical layout of the site, its hydrogeological setting, and the history of its use.

2.10 SITE DESCRIPTION AND HYDROGEOLOGICAL SETTING

The project site is an area roughly one acre in size surrounding Oil Tank #5 (OT5), located on the Naval Submarine Base - New London, in Groton, Connecticut (refer to Figure 1, Locus Plan). The site is situated just north of Crystal Lake Road, between Sculpin Avenue and Tang Avenue.

According to the 1984 U. S. Geological Survey topographical map for the Uncasville, Connecticut quadrangle, the site is located in the eastern portion of a fairly level, open area on the east side of the Thames River. The Thames River is located approximately 0.3 miles to the west of the site. The topography of the surrounding area is generally hilly, rising to elevations in excess of two hundred feet above sea level within one-half mile to the north, east and south. Bedrock outcrops were observed on the north side of Tang Avenue, across from the site.

Information provided by the Base's Public Works Department (PWD) indicates that the site is located at the east end of an area formerly occupied by Crystal Lake. Crystal Lake was filled, reportedly with sand, to the present grades. The area is currently used as an underground fuel and waste oil tank farm, and recreational playing fields.

As part of this study, a topographic plan (Figure 2, Topographic Plan) was developed based on a field survey performed by GZA personnel. As shown on Figure 2, the ground surface surrounding OT5 is fairly uniform in grade at an elevation of approximately 22 feet above sea level, rising abruptly several feet in elevation at the edge of Tang Avenue. The landscaping of the site appears to be well maintained, and consists predominantly of mown grass. Intermittent oak trees are present alongside Tang Avenue, and several maple and small pine trees are located southeast of the tank.

Several small structures, utility manholes and fenced enclosures are located within the immediate area of the tank. Additionally, several subsurface utilities consisting of electrical, drainage, and waste lines are located within the immediate area of OT5. GZA reviewed existing site plans at the PWD to identify and locate subsurface utilities. All topographical and man-made features, including subsurface utilities, are shown on Figure 3, Site/Utility Plan. The actual field "as-built" locations of the utilities may differ from those shown on Figure 3; the locations shown should be considered approximate, and should be verified in the field prior to any construction work.

A plan provided by the PWD entitled "Demolition, Oil Tank Five (5), Existing Conditions", dated August 2, 1989, shows the tank as a round, reinforced concrete structure with an outer diameter of 112'-4", and a depth of 11'-0". The 10-inch thick cover slab is supported by thirty-seven 16-inch diameter columns spaced at 16 feet on-center. The top of the concrete tank cover slab is located at a depth of approximately 4 feet below existing grade.

Based on a review of the area's topography and the USGS reference, GZA anticipates that the regional groundwater flow across the site is generally to the west, towards the Thames River.

2.20 SITE HISTORY

PWD personnel provided information to GZA regarding the history and usage of OT5. OT5 was constructed in the 1940's (possibly 1942), during World War II, and was initially used as a fuel oil storage tank. Ten to fifteen years ago the tank was converted for use as a waste storage tank. The waste deposited in the tank was reported to be predominantly oily bilge water pumped from Navy vessels.

OT5 was recently taken out of service, and was replaced with a new system consisting of a 30,000-gallon oily waste containment tank, an oil/water separator, and a waste oil tank. The truck dumping pad and trough located partially above OT5 on the southern edge is currently used to receive bilge water from tank trucks, with the waste line running over OT5 to the new oily waste containment tank.

In 1989, a contract was awarded to a construction company to abandon OT5 in-place. The work was to include removal of residual waste oil in OT5, and the cleaning, partial demolition and filling of the concrete structure. Several of the subsurface utilities described above were scheduled to be removed under this contract, however no as-built drawings were developed to document the actual work performed. All subsurface utilities, including those scheduled to be removed, are shown on Figure 3.

In order to gain machinery access to the tank's interior, the sump house formerly located on the east edge of the tank was demolished, and the soil cover over the tank top in this area was excavated to expose the concrete. A hole approximately 10 feet by 15 feet was broken through the cover at this location. Additionally, the soil beside OT5 at this location was excavated roughly five feet below the top of the tank to provide a sump hole for groundwater and runoff control.

The water and waste oil inside the tank was pumped to tank trucks and was hauled off site for disposal. Reportedly, complications arose when the fluid level in the tank was drawn down to approximately 6 inches above the bottom of the tank. At this point, the remaining waste consisted predominantly of heavier oil sludge material that did not flow as easily.

A small bulldozer was used inside the tank to push the sludge towards the opening for removal. Analytical testing performed during the removal of this waste indicated that the sludge in the bottom of the tank contained polychlorinated biphenyls (PCBs) in excess of 10 parts per million (ppm).

At this time, demolition work was terminated because the original budget and scope of work did not include the handling and disposal of PCBs. It was determined that a more comprehensive work plan would have to be developed prior to any additional work. The findings of this study are to be used to aid in the development of specifications for additional work.

3.00 SUBSURFACE EXPLORATIONS AND CONDITIONS

As part of this study, GZA completed a limited field exploration program, consisting of the completion of four shallow test borings. Exploration locations are shown on Figure 2.

3.10 TEST BORINGS AND SOIL SAMPLING

GZA completed four borings, designated GZ-1 through GZ-4, around the perimeter of OT5. The explorations were performed by GZA Drilling, Inc. of Brockton, Massachusetts, on October 29, 1991, and were observed by a GZA engineer. The borings were advanced to depths ranging from 20 to 22 feet below existing grade. The locations and elevations of the borings were obtained during a topographic survey performed by GZA personnel. Boring locations are shown on Figure 2; logs of the borings may be found in Appendix B.

The drilling was performed using 3-3/4" hollow stem augers with no drilling fluids. Split spoon soil samples were obtained at 5-foot intervals in conformance with ASTM D-1586, the Standard Penetration Test (SPT). The soil samples were placed in clean, 8-oz glass jars, packed in a cooler with ice, and transported to GZA's Providence, Rhode Island office for preliminary VOC screening.

Groundwater measurements were obtained within the hollow stem augers at the completion of the borings. Groundwater was allowed to stabilize approximately 10 minutes prior to the readings.

3.20 SUBSURFACE CONDITIONS

The generalized subsurface profile at the site consists of a layer of medium dense to very dense sand and gravel fill to a depth of less than five feet, underlain by a very loose to loose silty sand fill to depths ranging from 14 feet at GZ-3 to 18 feet at GZ-1, -2, and -4. The silty sand fill frequently possessed trace amounts of organic material. Underlying the fill was a layer of dense, stratified sand and silt to the full depths of the borings.

Groundwater was encountered at depths ranging from 5.7 to 8.2 feet below ground surface at an average elevation of 16 feet above mean sea level. It should be noted that the groundwater readings were obtained in the borehole with a stabilization time of approximately ten minutes. With the lack of observation wells and fully stabilized readings, the groundwater level measurements should only be considered approximate. Groundwater levels may vary due to seasonal effects and other factors that are different from the conditions at the time the borings were performed.

Bedrock was not encountered in any of the borings, however a massive rock outcrop is located on the north side of Tang Avenue, within an estimated 100 feet of the site. Refusal of the split spoon sampler was encountered at 15 and 20 feet in boring GZ-3. It was not determined whether the refusal at 20 feet was due to bedrock or boulders.

4.00 ENVIRONMENTAL SAMPLING AND ANALYSES

Samples of soil, waste oil and sludge were collected during the subsurface exploration program. Selected samples were submitted for a series of chemical screenings and analyses, as detailed below.

4.10 SOIL SAMPLING, CHEMICAL SCREENING, AND ANALYSES

Split spoon soil samples were collected at five-foot intervals in each of the four auger borings. The samples were placed in clean, 8-oz jars, packed in ice, and transported to GZA's Providence, Rhode Island office. A series of chemical screenings and laboratory analyses were performed on the soil samples, as described below. Laboratory data sheets, with copies of the Chain of Custody forms, are contained in Appendix C.

4.11 PID Screening

All thirty-nine soil samples collected from the borings were screened for total volatile organic compounds (VOCs) in GZA's Providence office. The preliminary screening was performed in the sample jar headspace using an HNU Model PI-101 photoionization detector (PID) with a 10.2 electron-volt lamp. The PID measures relative

levels of VOCs referenced to a benzene in air standard. Although the PID screening cannot be directly used to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator of the levels of VOCs in each sample. Laboratory PID screening procedures are presented in Appendix C.

The PID screening results, summarized in Table 1, indicate that of the 39 samples screened, only four registered total VOC levels of 1.0 ppm or greater, with a peak of 4.8 ppm recorded. The sample with the highest total VOC reading was collected from a depth of 10 to 12 feet in boring GZ-1, located on the down-gradient side of Waste Oil Tank #5. PID readings between 0 (ND) and 1.0 ppm were recorded in 10 other samples obtained from all four borings.

4.12 GC Screening

Based on the PID screening results, six soil samples (GZ-1/S-3dup., GZ-1/S-5b, GZ-2/S-5, GZ-3/S-2dup., GZ-4/S-1, and GZ-4/S-2) were submitted to GZA's Environmental Chemistry Laboratory for screening by static headspace gas chromatograph (GC) techniques using a Hewlett Packard Model 5890A GC. GC screening identifies individual compounds present and estimates their respective concentrations. Descriptions and results of GZA's GC screening procedures are included in Appendix C. As summarized below, various "unknown" VOC compounds were detected in four of the samples, three of which were samples with elevated HNU readings from borings GZ-1 and GZ-4.

SAMPLE NO.	COMPOUNDS DETECTED	METHANE	# UNKNOWN COMPOUNDS	NOTES
GZ-1/S-3	ND	ND	39	1.
GZ-1/S-5B	ND	ND	NONE	---
GZ-2/S-5	ND	ND	NONE	---
GZ-3/S-2	ND	ND	1	2.
GZ-4/S-1	ND	ND	18	3.
GZ-4/S-2	ND	ND	4	4.

NOTES:

1. Unknowns tentatively identified as a petroleum distillate, such as fuel oil.
2. Unknown tentatively identified as methanol, an artifact inherent to the test method and most likely not present in the sample.
3. One of the unknown compounds is tentatively identified as methanol, as described in Note 2. The remaining compounds are tentatively identified as an unknown petroleum distillate, such as fuel oil.

4. One of the unknown compounds is tentatively identified as methanol, as described in Note 2. The remaining compounds are not identified.

4.13 Total Petroleum Hydrocarbons

Based on the GC screening results, which indicate the possible presence of fuel oil contamination, soil samples GZ-1/S-3dup., GZ-4/S-1, and GZ-4/S-2 were submitted to GZA's Environmental Chemistry Laboratory for total petroleum hydrocarbon (TPH) analysis. The samples were analyzed for TPH using EPA Method 418.1 (spectrophotometric, infrared), which indicates the total concentration of petroleum hydrocarbons present in the sample. The results of the analyses are contained in Appendix C, and are summarized in the table in Section 4.14.

4.14 Petroleum Hydrocarbon Fingerprinting

Sample GZ-1/S-3dup. and sample GZ-4/S-1 were submitted for petroleum hydrocarbon (PHC) fingerprinting analysis at GZA's Environmental Chemistry Laboratory using modified ASTM Method D3328. The analysis identifies the type of petroleum product present and the relative degree of weathering. Laboratory data sheets are included in Appendix C; the results are presented in the following table, along with the TPH test results.

SAMPLE	TPH (ppm)	PHC FINGERPRINT
GZ-1/S-3dup	590	75% #4 FUEL OIL (SEVERE WEATHERING) 25% #6 FUEL OIL
GZ-4/S-1	9200	50% #4 FUEL OIL (MODERATE WEATHERING) 50% #6 FUEL OIL
GZ-4/S-2	380	(NOT TESTED)

4.15 Polychlorinated Biphenyls and Pesticides

Two soil samples, GZ-1/S-3dup. and GZ-4/S-1, were analyzed at GZA's Environmental Chemistry Laboratory for polychlorinated biphenyls (PCBs) and pesticides by EPA Method 8080. Laboratory results are included in Appendix C and are summarized in the following table.

8080 COMPOUNDS	CONCENTRATION (ppb)	
	GZ-1/S-3	GZ-4/S-1
<u>PCBs:</u> AROCLOR 1260	ND	32
<u>PESTICIDES:</u> ALPHA-BHC BETA-BHC DELTA-BHC HEPTACHLOR EPOXIDE	930 ND 230 240	530 120 ND 110

4.20 WASTE OIL AND SLUDGE SAMPLING AND ANALYSES

Measurements of the fluid levels in the tank were obtained at the time the samples were collected. The measurements indicated that there is a total of approximately 3.3 feet of fluid in the tank, comprised of three separate layers: floating oil product, water, and sludge/sediment. The material in the tank appeared to consist predominantly of water, with approximately 1 to 2 inches of a thick, black oil floating layer. The sludge thickness at the bottom of the tank was estimated to be approximately 6 inches, with a greater thickness in the sump pit located under the transfer pump house. According to available structural drawings of the tank, the sump pit is two feet deep by five foot square. A second sump pit exists near the west edge of the tank at the location of the former sump pump house.

The consistency of the floating oil product is similar to #4 fuel oil, while the sludge is a very thick, jelly-like viscous fluid, non-uniform in consistency. According to PWD personnel, miscellaneous debris may be mixed with the sludge/sediments. During the previous contract to abandon OT5, debris observed in the bottom of the tank included leaves, rags, cans, wood, and a 55-gallon drum. Additionally, detergents used to clean the ship's bilges may be mixed with the waste materials, causing the water and oil to emulsify:

Two samples of the waste oil sludge in the bottom of OT5 were obtained by GZA personnel on November 2, 1991. The samples, designated S-1 and S-2, were taken from two separate locations: from the opening in the floor of the existing transfer pump house near the center of the tank (S-1), and from the existing fill opening on the southwestern edge of the tank (S-2). The samples were collected using a clean, plastic scoop mounted on a 3/4 -inch diameter steel rod. The scoop was pushed into the sludge and removed to obtain the sample.

Two samples of the floating oil layer, designated S-1a and S-2a, were also obtained from each location for possible laboratory analysis. The collection of these two additional samples was not included in our scope of work, however we felt that analysis of the floating waste oil would provide valuable information. It was not anticipated at the time the original scope was developed that materials other than sludge and sediments were present inside OT5.

The samples were placed in clean 8-oz jars, packed on ice in a cooler, and transported to GZA's Providence office. Duplicates of each sample were obtained to provide a sufficient quantity of sludge and waste oil for analysis.

The samples of waste oil sludge (S-1 and S-2) and waste oil floating product (S-1a and S-2a) were submitted for a series of laboratory analyses as described below.

4.21 Volatile Organic Compounds (VOCs)

One sample of the floating oil product, S-1a, was submitted to GZA's Environmental Chemistry Laboratory for volatile organic compounds (VOCs) analysis by EPA Method 8240. This analysis was intended for soil samples in our scope of work, however we felt that the information could aid in the evaluation of disposal options. This analysis identifies compounds present and their respective concentrations. The laboratory results are attached in Appendix C, and are presented in the following table.

COMPOUND	CONCENTRATION (ppb) SAMPLE S-1a
METHYLENE CHLORIDE	7,700
TETRACHLOROETHENE	5,700
TOLUENE	8,600
ETHYL BENZENE	9,200
ACETONE	26,000
2-BUTANONE (MEK)	79,000
TOTAL XYLENES	52,000

4.22 Total Petroleum Hydrocarbons

Both sludge samples, S-1 and S-2, and one floating oil product sample, S-1a, were analyzed at GZA's Environmental Chemistry Laboratory for TPH by modified ASTM Method D3328. The laboratory results are included in Appendix C. The results of the tests are presented in the following table.

SAMPLE NO.	S-1	S-2	S-1a
TPH (ppm)	110,000	280,000	540,000

4.23 Polychlorinated Biphenyls (PCBs) and Pesticides

The two sludge samples (S-1 and S-2) and both floating oil product samples (S-1a and S-2a) were submitted to GZA's Environmental Chemistry Laboratory for analysis for pesticides and PCBs using EPA Method 8080. The laboratory results are included in Appendix C and are presented in the following table.

8080 COMPOUNDS	CONCENTRATION (ppb)			
	S-1	S-1a	S-2	S-2a
PCBs: AROCOR 1260	36,000	57,000	650,000	160,000
PESTICIDES: ALPHA-BHC	2,800	490	2,600	ND
BETA-BHC	ND	ND	ND	ND
DELTA-BHC	800	ND	ND	ND
HEPTACHLOR EPOXIDE	850	ND	ND	ND

4.24 Metals

The two sludge samples, S-1 and S-2, were submitted to Rhode Island Analytical Laboratories, Inc. in Warwick, Rhode Island for priority pollutant metals analysis (total basis). The laboratory data sheets are included in Appendix C; the results are presented in the following table.

PARAMETER	CONCENTRATION (mg/kg)	
	S-1	S-2
ANTIMONY	3.84	4.67
ARSENIC	0.54	0.76
BERYLLIUM	<1.00	141
CADMIUM	7.14	6.67
CHROMIUM	123	103
COPPER	868	647
LEAD	217	275
MERCURY	1.00	1.00
NICKEL	75.0	70.5
SELENIUM	<0.50	<0.50
SILVER	3.57	3.81
THALLIUM	<0.50	<0.50
ZINC	9.82	894

5.00 SUMMARY AND CONCLUSIONS

A limited environmental study was conducted at the Waste Oil Tank #5 (OT5) site, located between Tang Avenue and Sculpin Avenue on the Naval Submarine Base - New London, in Groton, Connecticut. The study included the development of a site topographic plan, a limited subsurface exploration program, the sampling of residual waste in OT5, and the chemical screening and/or analyses of soil, waste oil, and sludge samples. The purpose of the study was to characterize the nature and extent of contaminants at the site in order to aid in the development of specifications for the abandonment of OT5 in-place.

On the basis of the work conducted as part of this study, GZA has reached the following conclusions.

- (1) OT5 is a 275,000-gallon underground concrete tank constructed in the early 1940's. OT5 was initially used as a fuel oil storage tank, but was converted 10 to 15 years ago to a waste oil storage tank. The waste deposited in OT5 was reported to consist predominantly of oily bilge water pumped from Navy vessels, however,


access to the tank was not secured. OT5 was abandoned in-place in 1989; demolition work was terminated when PCBs were discovered in the waste oil sludge at the bottom of the tank.

- (2) Four shallow auger borings (GZ-1 through GZ-4) were conducted as part of this study to depths of 20 to 22 feet around the perimeter of OT5. The subsurface conditions in the vicinity of OT5 consist of sand and gravel fill to a depth of less than 5 feet, underlain by a silty fine sand fill, with trace amounts of organics, to depths of 14 to 18 feet below ground surface. Underlying the fill is a stratum of dense, naturally deposited stratified sand, gravel and silt. Groundwater was encountered at depths ranging from 5.7 to 8.2 feet below existing ground surface. Based on the area geology and surrounding topography, GZA anticipates that groundwater flow across the site is generally to the west, towards the Thames River.
- (3) During the field exploration and sampling program, a total of thirty-nine soil samples were collected from the auger borings. Additionally, two waste oil sludge, and two waste oil samples were collected from within OT5. A series of chemical screenings and/or analyses were performed on the samples as follows:
- PID Screening: All thirty-nine soil samples collected from borings GZ-1 through GZ-4 were screened for volatile organic compounds (VOCs) using a photoionization detector.
 - GC Screening: Six soil samples were screened for VOCs using a gas chromatograph.
 - Total Petroleum Hydrocarbons: Three soil samples and three waste oil/sludge samples were tested for total petroleum hydrocarbon content using EPA Method 418.1 and modified ASTM Method D3328.
 - Hydrocarbon Fingerprint: Two soil samples were analyzed using petroleum hydrocarbon fingerprinting, modified ASTM Method D3328, in order to identify the type of petroleum product present in the samples.
 - PCBs and Pesticides: Two soil samples and four waste oil/sludge samples were analyzed using EPA Method 8080 to determine if PCBs or pesticides were present.
 - VOCs - EPA Method 8240: One sample of waste oil was analyzed for VOCs by EPA Method 8240.
 - Metals: Two sludge samples were analyzed for priority pollutant metals on a total basis.

- (4) The results of the chemical screening and analyses performed on soil samples identified at least two areas of contamination in the soil surrounding OT5. One area was detected by analyses of a sample collected from a depth of 10 to 12 feet at boring GZ-1, roughly four to six feet below the existing groundwater table. The soil sample at this location contained fuel oil and pesticides. Boring GZ-1 is located on the downgradient side of OT5. The occurrence of petroleum contamination below the groundwater level may indicate that leakage from OT5 has occurred. The second area of contaminated soil detected by analyses of soil samples collected from depths of 0 to 2 and 5 to 7 feet at boring GZ-4. The soil samples collected at this location contained fuel oil and pesticides. The sample collected from 0 to 2 feet also contained PCBs. The occurrence of contamination above the groundwater table, and the proximity of GZ-4 to the former fill opening and current truck dumping pad, suggest that surficial spills have occurred in the past.
- (5) The 3.3 feet of residual material inside OT5 consists of three separate layers: floating oil product, water, and sludge/sediments. The floating oil layer was approximately 1 to 2 inches in thickness, while the sludge layer was roughly 6 inches thick; the remainder was water. The sludge thickness was observed to be greater in one of two sump pits located in the floor of OT5. Two sump pits are shown on available structural drawings. The waste oil and waste oil sludge are very high in petroleum hydrocarbon content, with measured levels ranging from 110,000 ppm to 540,000 ppm. Aroclor 1260 (PCB) was detected at concentrations ranging from 36,000 ppb to 650,000 ppb, as well as several pesticide compounds. Total metals analysis indicated the presence of several priority pollutant metals, most notably beryllium, chromium, copper, lead, nickel, and zinc. VOCs analysis of the floating oil product indicated the presence of the following compounds: Methylene chloride, tetrachloroethene, toluene, ethyl benzene, acetone, 2-butanone (MEK), and xylenes; concentrations of these compounds ranged from 7.7 to 52 ppm. The use of detergents to clean ship's bilges suggests that emulsified hydrocarbons may be present in the water layer, as well as VOCs.

In conclusion, the waste oil and sludge within OT5 contains PCBs, pesticides, VOCs, and metals. Petroleum and pesticides contamination outside OT5 occurs below the groundwater table on the downgradient (west) side of the tank, and above the groundwater table in the vicinity of the former fill area and current truck dumping pad. PCBs were also detected near the ground surface adjacent to the former fill area and truck dumping pad. The occurrence and nature of the contamination suggests that both leakage from the tank and surficial spills have occurred in the past. This limited subsurface exploration program did not identify the extent of contamination in the soil outside OT5.

6.00 LIMITATIONS



GZA's environmental study was performed in accordance with general accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area, and GZA observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. GZA's findings and conclusions must be considered not as scientific certainties, but rather as our professional opinion concerning the significance of the limited data gathered during the course of the environmental study. No other warranty, express or implied, is made. Specifically, GZA does not and cannot represent that the site contains no hazardous material, oil, or other latent condition beyond that observed by GZA during its study. This report is subject to the specific limitations contained in Appendix A.

TABLES

TABLE 1

PID SCREENING OF SOIL SAMPLES

BORING NO.	SAMPLE NO.	DEPTH (FT.)	HNU READING
GZ-1	S-1a	0-2	ND
	S-1b	0-2	ND
	S-2	5-7	ND
	S-2 DUP	5-7	ND
	S-3	10-12	1.0
	S-3 DUP	10-12	4.8*
	S-4	15-17	0.2
	S-4 DUPa	15-17	0.2
	S-4 DUPb	15-17	0.4
	S-5a	20-22	0.2
	S-5b	20-22	0.6*
GZ-2	S-1a	0-2	ND
	S-1b	0-2	ND
	S-2	5-7	ND
	S-3	10-12	ND
	S-3 DUP	10-12	ND
	S-4	15-17	ND
	S-4 DUP	15-17	ND
	S-5	20-21.5	0.3*
GZ-3	S-1	0-2	ND
	S-1 DUPa	0-2	0.2
	S-1 DUPb	0-2	0.1
	S-2	5-7	ND
	S-2 DUPa	5-7	ND*
	S-2 DUPb	5-7	ND
	S-3	10-12	ND
	S-3 DUP	10-12	ND
GZ-4	S-1	0-2	1.0*
	S-1 DUP	0-2	0.4
	S-2	5-7	0.7
	S-2 DUP	5-7	1.2*
	S-3	10-12	ND
	S-3 DUPa	10-12	ND
	S-3 DUPb	10-12	ND
	S-4	15-17	ND
	S-4 DUPa	15-17	ND
	S-4 DUPb	15-17	ND
	S-5a	20-22	ND
	S-5b	20-22	ND

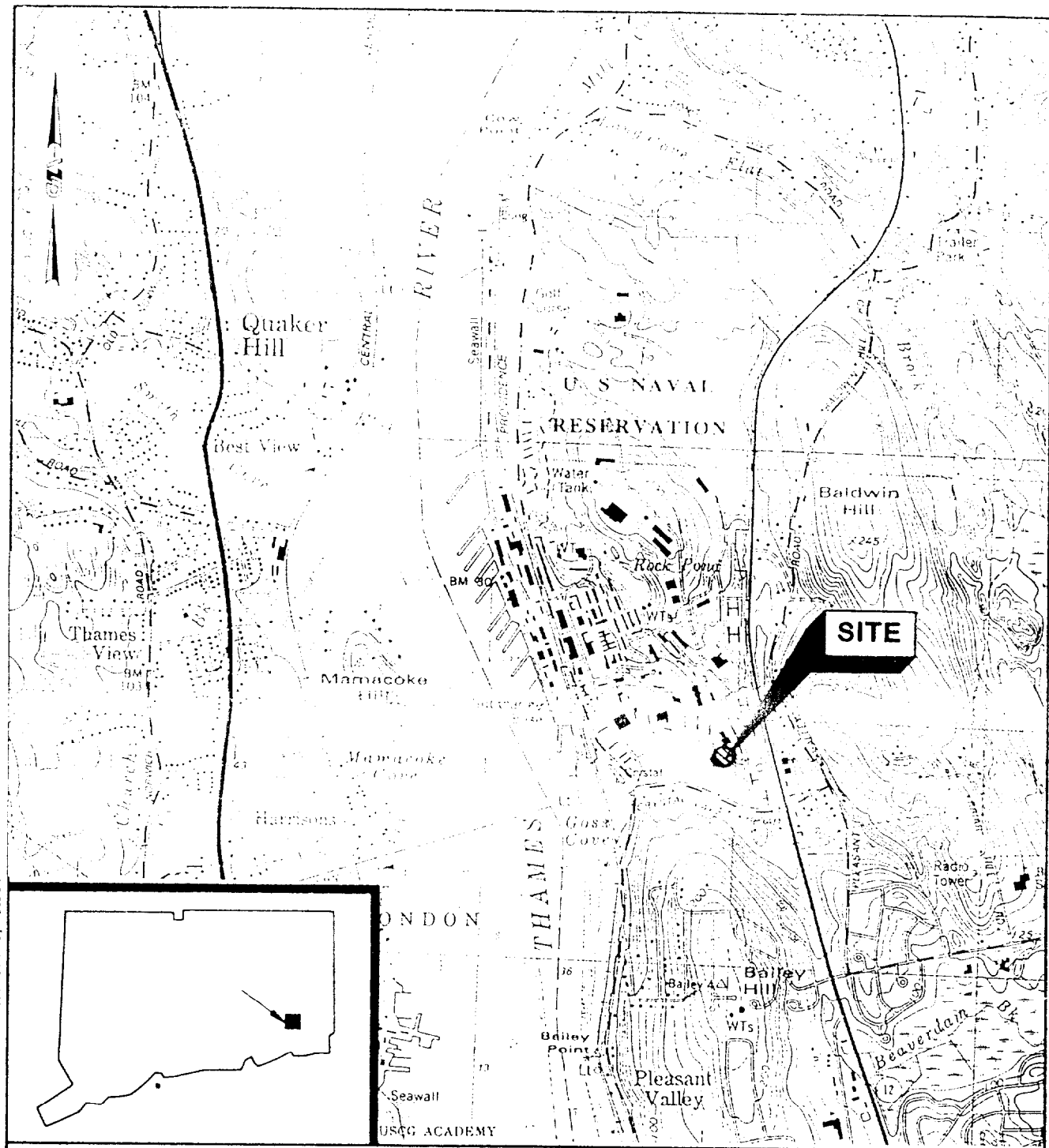
NOTES:

- 1- PID readings represent total volatile organic compounds detected in soil samples using an HNU photoionization detector, Model PI-101. These concentrations are reported in parts per million (ppm), referenced to a benzene in air standard.
- 2- ND indicates "not detected".
- 3- * indicates sample selected for additional VOC screening.

FIGURES

© 1991 GZA GeoEnvironmental, Inc.

File No. 30894



FROM USGS UNCASVILLE, CONN. QUADRANGLE MAP

SCALE IN FEET

0' 1000' 2000' 4000'



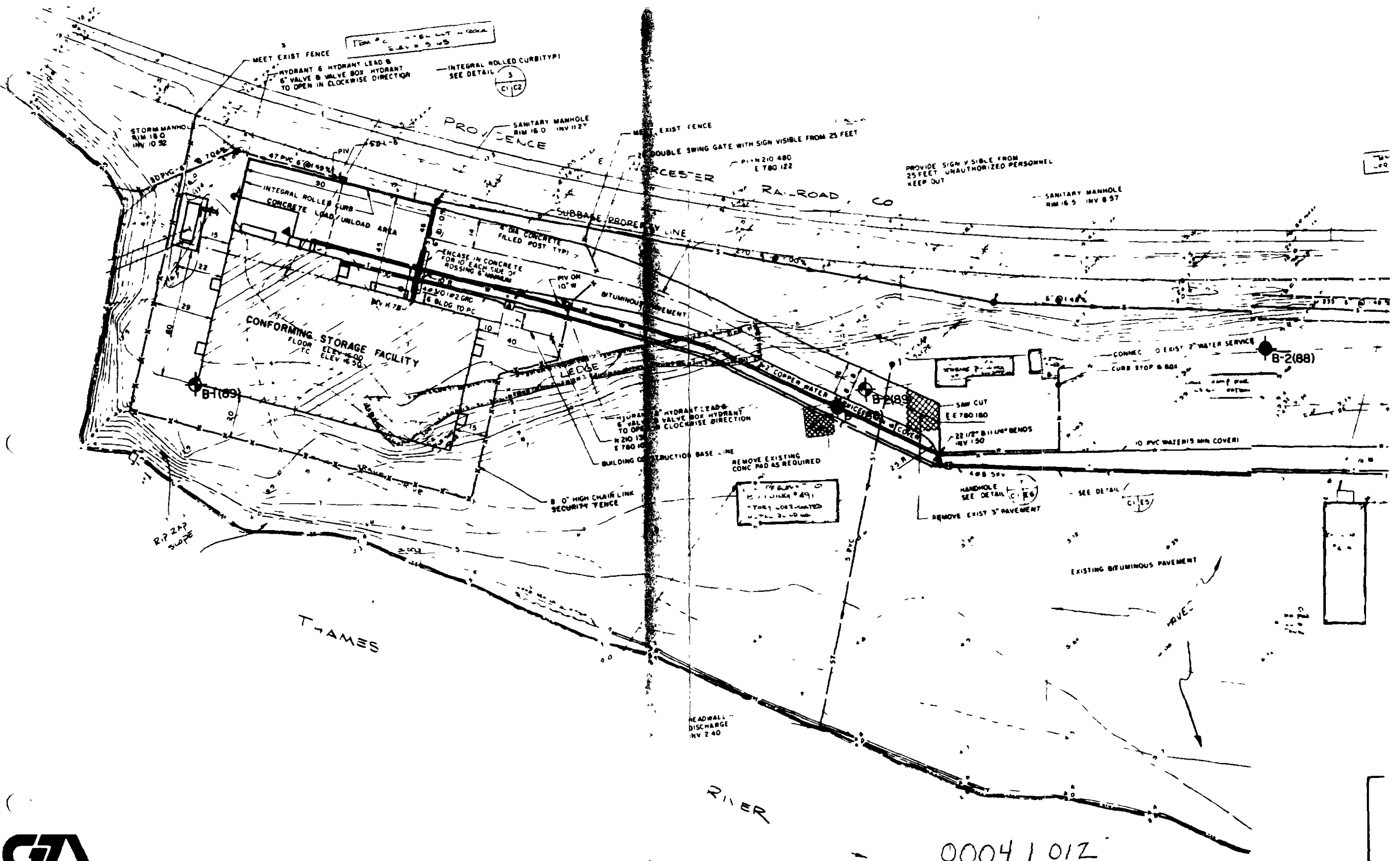
WASTE OIL TANK
NO. 5

GROTON, CONNECTICUT

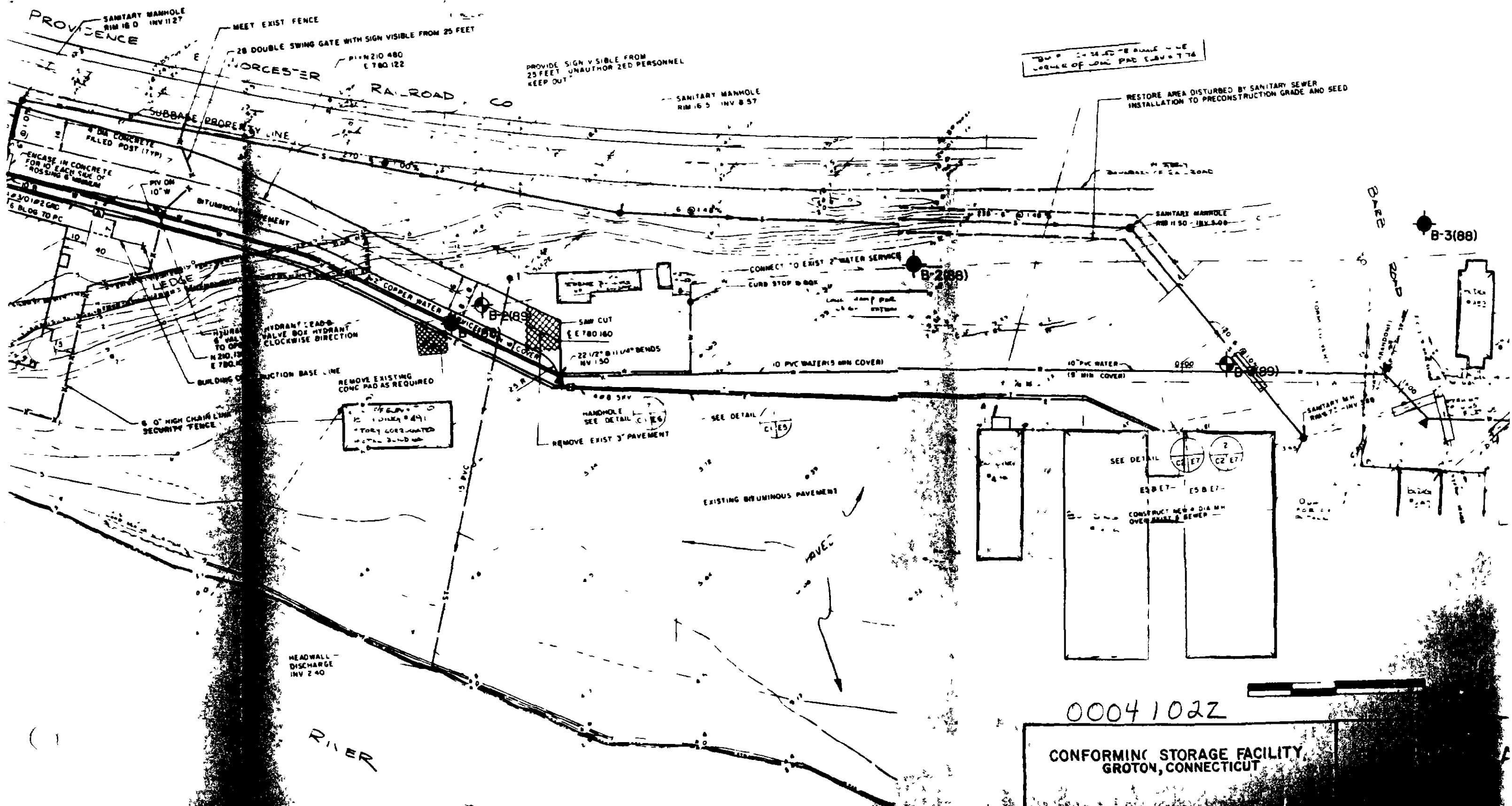
LOCUS PLAN

DECEMBER 1991

FIGURE NO. 1



0004101Z



TO BE SET TO RAILROAD
CORNER OF LONG PAD ELEV 7.74

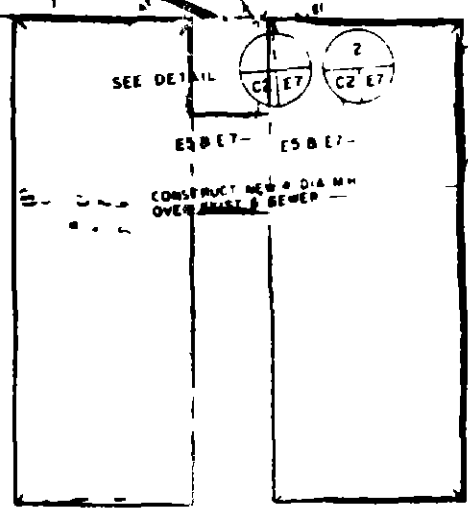
RESTORE AREA DISTURBED BY SANITARY SEWER
INSTALLATION TO PRECONSTRUCTION GRADE AND SEED

B-3(88)

B-2(88)

B-1(88)

B-4(88)



0004102Z

CONFORMING STORAGE FACILITY
GROTON, CONNECTICUT

APPENDIX A

LIMITATIONS/STATEMENT OF TERMS AND CONDITIONS

SITE ASSESSMENT LIMITATIONS

1. The observations described in this report were made under the conditions stated therein. The conclusions presented in the report were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by Client. The work described in this report was carried out in accordance with the attached Statement of Terms and Conditions.
2. In preparing this report, GZA GeoEnvironmental, Inc. has relied on certain information provided by state and local officials and other parties referenced therein, and on information contained in the files of state and/or local agencies available to GZA GeoEnvironmental at the time of the site assessment. Although there may have been some degree of overlap in the information provided by these various sources, GZA GeoEnvironmental did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this site assessment.
3. In the event that bank counsel or title examiner for Client obtains information on environmental or hazardous waste issues at the site not contained in this report, such information shall be brought to GZA GeoEnvironmental's attention forthwith. GZA GeoEnvironmental will evaluate such information and, on the basis of this evaluation, may modify the conclusions stated in this report.
4. Observations were made of the site and of structures on the site as indicated within the report. Where access to portions of the site or to structures on the site was unavailable or limited, GZA GeoEnvironmental renders no opinion as to the presence of hazardous material or oil, or to the presence of indirect evidence relating to hazardous material or oil, in that portion of the site or structure. In addition, GZA GeoEnvironmental renders no opinion as to the presence of hazardous material or oil, or to the presence of indirect evidence relating to hazardous material or oil, where direct observation of the interior walls, floor, or ceiling of a structure on a site was obstructed by objects or coverings on or over these surfaces.
5. Unless otherwise specified in the report, GZA GeoEnvironmental did not perform testing or analyses to determine the presence or concentration of asbestos or polychlorinated biphenyls (PCB's) at the site or in the environment at the site.
6. The purpose of this report was to assess the physical characteristics of the subject site with respect to the presence in the environment of hazardous material or oil, as defined in Massachusetts General Laws Chapter 21E. No specific attempt was made to check on the compliance of present or past owners or operators of the site with federal, state, or local laws and regulations, environmental or otherwise.
7. The conclusions and recommendations contained in this report are based in part upon the data obtained from a limited number of soil and/or groundwater samples obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until further exploration. If variations or other latent conditions then appear evident, it will be necessary to reevaluate the conclusions and recommendations of this report.
8. Water level readings have been made in the test pits, borings, and/or observation wells at the times and under the conditions stated on the test pit or boring logs. However, it must be noted that fluctuations in the level of groundwater may occur due to variations in rainfall and other factors different from those prevailing at the time measurements were made.

9. Except as noted within the text of the report, no quantitative laboratory testing was performed as part of the site assessment. Where such analyses have been conducted by an outside laboratory, GZA GeoEnvironmental has relied upon the data provided, and has not conducted an independent evaluation of the reliability of these data.
10. The conclusions and recommendations contained in this report are based in part upon various types of chemical data and are contingent upon their validity. These data have been reviewed and interpretations made in the report. As indicated within the report, some of these data are preliminary "screening" level data, and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time, and other factors. Should additional chemical data become available in the future, these data should be reviewed by GZA GeoEnvironmental, and the conclusions and recommendations presented herein modified accordingly.
11. Chemical analyses have been performed for specific parameters during the course of this site assessment, as described in the text. However, it should be noted that additional chemical constituents not searched for during the current study may be present in soil and/or groundwater at the site.
12. It is recommended that GZA GeoEnvironmental be retained to provide further engineering services during construction and/or implementation of any remedial measures recommended in this report. This is to allow GZA GeoEnvironmental to observe compliance with the concepts and recommendations contained herein, and to allow the development of design changes in the event that subsurface conditions differ from those anticipated.

STATEMENT OF TERMS AND CONDITIONS OF ENGAGEMENT

The terms and conditions set forth herein are incorporated, by reference, in the Proposal for Services, dated October 7, 1991, File Number 30894, directed to The EADS Group (the "Client").

This Proposal contains clauses that limit Company's liability to Client and require Client to indemnify Company for some claims for damages. The Proposal should be reviewed carefully, and Client may choose to consult with an attorney.

GZA GeoEnvironmental, Inc. ("Company") and Client agree as follows:

Section 1. Services. Company shall provide Client with the "Services" set forth in the Proposal for Services ("Proposal") with respect to the property identified in the Proposal (the "Site"), under the terms and conditions set forth herein. Company's Services will be performed on behalf of and solely for the exclusive use of Client for the purposes set forth in the Proposal and for no other purpose. Client acknowledges that Company's Services require decisions which are based upon judgment stemming from limited data rather than upon scientific certainties. Client, in accepting Company's Proposal, acknowledges the inherent risks to Client and its property associated with the work described in the Proposal and with underground work in general. Company reserves the right to refuse to undertake services on behalf of any project or on behalf of any prospective Client. Client acknowledges that other qualified persons and entities are available to carry out the proposed Services.

Section 2. Billing and Payment. Client will pay Company for services performed in accordance with the rates and charges set forth in the Proposal. Invoices for Company's services will be submitted on a periodic basis, or upon completion of Services, as Company shall elect. All invoices will be paid by Client within thirty (30) days after invoice date. Invoice balances remaining unpaid for thirty (30) days after invoice date will bear interest from invoice date at 1.5 percent per month or at the maximum lawful interest rate, if such lawful rate is less than 1.5 percent per month. If Client fails to pay any invoice in full within thirty (30) days after invoice date, Company may, at any time, and without waiving any other rights or claims against Client and without thereby incurring any liability to Client, elect to terminate performance of Services upon ten (10) days prior written notice by Company to Client. Notwithstanding any termination of Services by Company for non-payment of invoices, Client shall pay Company in full for all Services rendered by Company to the date of termination of Services plus all interest, termination costs and expenses incurred by Company and related to such termination. Client shall be liable to reimburse Company for all

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costs and expenses of collection, including reasonable attorneys' fees. Company's non-exercise of any rights or remedies, whether specified herein or otherwise provided by law, shall not be deemed a waiver of any such rights or remedies, nor preclude Company from the exercise of such rights or other rights and remedies under this instrument, or at law.

Section 3. Insurance. Company maintains Workers Compensation Insurance with respect to its employees with statutorily required limits. Company maintains public liability and property damage insurance policies. Certificates of Insurance evidencing such coverage will be provided to Client upon written request.

Section 4. Right of Entry. Client grants to Company the right, exercisable from time to time, of entry to the Site by Company, its agents, employees, consultants, contractors and subcontractors, for the purpose of performing all acts, studies and research, including the making of test borings and other explorations as described in the Proposal. Should Client not own the Site, Client warrants and represents by acceptance of the Proposal that it has authority and permission of Site Owner and any Site occupant to grant Company this right of entry. Company may require evidence of such authority in a form reasonably satisfactory to Company.

Section 5. Subsurface Explorations.

(a) **Normal Disturbance** - Client acknowledges that the use of exploration equipment may affect, alter or damage the terrain, vegetation and buildings, structures, improvements and equipment at, in or upon the Site. Client accepts such risks. Company will not be liable for any effect, alteration or damage arising out of such explorations except that caused by Company's negligent acts. The cost of restoration of the Site because of any such damage has not been calculated nor included in Company's fees.

(b) **Subterranean Structures** - Company will exercise a reasonable degree of care in seeking to locate subterranean structures in the vicinity of proposed subsurface explorations at the Site. Company will contact public utilities and review plans, if any, provided by public utilities and public agencies and plans and information about the Site provided by Client. So long as Company observes such standard of care, Company will not be responsible for any damage, injury or interference with any subterranean structure, pipe, tank, cable or any other element or condition if not called to Company's attention prior to commencement of work or which is not shown, or accurately located, on any plans furnished to Company by Client or by any other party, (public or private).

Section 6. Samples

(a) **General** - Company will dispose of all soil, rock, water and other samples thirty (30) days after submission of Company's initial report. Client may request, in writing, that any such samples be retained beyond such date, and in such case Company will ship such samples to the location designated by Client, at Client's expense. Company may upon written request arrange for storage of samples at one of Company's offices, at mutually agreed storage charges. Company will not give Client prior notice of intention to dispose of samples.

(b) **Disposal of Hazardous Samples** - If samples collected from the Site contain substances defined as "hazardous" by Federal, state or local statutes, regulations, codes, or ordinances, Company shall have the right to: 1) dispose of samples by contract with a qualified waste disposal contractor; or 2) in accordance with Client's written directions, ship such samples by an appropriately licensed transporter to a licensed disposal site. Client shall pay all costs and expenses associated with the collection, storage, transport and disposal of samples. If Client requests, in writing, that any such sample be retained for a period in excess of thirty (30) days, Company will store such samples at Client's expense, and Client will pay an additional fee as charged by Company in accordance with its standard laboratory schedule for storage of samples of a hazardous nature.

Section 7. Construction Observation Services; Duties.

(a) **General** - Company, upon Client's written request, will provide personnel to observe and report to Client on specific aspects or phases of Client's project construction. Company's observation Services do not include any supervision or direction of work of any contractor or subcontractor, or their respective employees, agents or servants. Client shall notify each contractor and subcontractor that Company's observation Services do not include supervision or direction of the work and that neither the presence of Company's field representative nor the Services of observation and testing by Company, shall excuse the contractor or any subcontractor from the obligation to correct any defects then or thereafter discovered in the respective contractor's or subcontractor's work. Company will not be responsible for any contractor's or subcontractor's compliance with the provisions of any contract nor for the observation or supervision of any contractor's or subcontractor's use of personnel, machinery, equipment, safety precautions or procedures.

(b) **Construction Site Safety** - Company, by entering into an agreement with Client or by performing construction observation services, does not undertake any liability or responsibility for the development, supervision, or enforcement of any job or site safety requirements; nor for any failure of any contractor, subcontractor, or other third person or entity present on the Site to comply with the Occupational Safety and Health Act (Federal OSHA), or with any regulations or standards promulgated thereunder, or with any state, county, or municipal law, regulation, or ordinance of similar import or intent.

Section 8. Documents. All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates and other documents, data or information prepared by Company as instruments of Service, shall remain the sole property of Company. All reports and other work prepared by Company for Client shall be utilized solely for the intended purposes and Site described in the Proposal. Company will retain all pertinent documents for a period of three (3) years following the submission of Company's report to Client. Such documents will be available to Client upon request at Company's office during office hours on reasonable notice, and copies will be furnished by Company to Client for the total cost of reproduction of the same.

Section 9. Client's Duty to Notify Company of Hazards. Client represents and warrants that it will provide Company with any and all information known to or suspected by Client with respect to 1) the existence or possible existence at, on or under the Site of any hazardous materials, pollutants or asbestos as defined in the Federal Water Pollution Control Act; the Federal Comprehensive Environmental Response, Compensation and Liability Act of 1980; the Resource Conservation and Recovery Act of 1976, or under the provisions of federal, state, and local laws of similar import now or hereafter existing, 2) any condition known to Client to exist in, on, under or in the vicinity of the Site which might present a potential safety hazard or danger to human health or the environment, or 3) any permit, manifest, title record, or other record of compliance or non-compliance with any federal, state, or local laws relating in any way, directly or indirectly, to the past or present environmental conditions at the site.

Section 10. Hazardous Materials; Pollutants; Asbestos. If unanticipated potentially hazardous materials, pollutants or asbestos are encountered during the course of the work, Company shall have the right 1) to suspend its work immediately and 2) to terminate the work described in the Proposal, upon ten (10) days of Company's written notice of intent to terminate, unless Company and Client agree upon a mutually satisfactory amendment to the Proposal that may include a revision of the scope of services, adjustment of budget estimates, revised Terms and Conditions and revised fees. Client shall remain liable for and shall pay all fees and charges incurred under the provisions of the Proposal through the date of termination, notwithstanding Client and Company not having reached a new, mutually satisfactory, revision of their agreement.

Section 11. Confidentiality. Company will not disclose information regarding the Proposal, Company's Services or its Report, except 1) to Client, 2) parties designated by Client, or 3) as provided in Section 12 below. Information which is in the public domain or which is provided to the Company by third parties is excepted from the foregoing undertaking.

Section 12. Public Responsibility. Client acknowledges that the Client or the Site owner, as the case may be, is now and shall remain in control of the Site for all purposes at all times. Company does not undertake to report to any Federal, state, county or local public agencies having jurisdiction over the subject matter any conditions existing at the Site from time to time which may present a potential danger to public health, safety or the environment. Client, by acceptance of the Proposal, agrees that Client will timely notify each appropriate Federal, state, county and local public agency, as required by law, of the existence of any condition at the Site which may present a potential danger to public health, safety or the environment.

Notwithstanding the provisions of Section 11 and the foregoing, Company will comply with judicial orders or governmental directives, and federal, state, county and local laws, regulations and ordinances, and applicable codes regarding the reporting to the appropriate public agencies of findings with respect to potential dangers to public health, safety or the environment. Company shall have no liability or responsibility to Client or to any other person or entity for reports or disclosures made in accordance with such statutory or other lawful requirements. Client shall defend, indemnify and hold Company harmless from and against any and all claims, demands, liabilities and expense, including reasonable attorneys' fees, incurred by Company and arising directly or indirectly in connection with Company's reporting or disclosing such information under a bona fide belief or upon advice of counsel that such reporting or disclosure is required by law.

Section 13. Governing Law; Severability; Modifications; Assignment. Company maintains offices in several states. The agreement between Company and Client as set forth in the Proposal and in these Terms and Conditions shall be governed by and enforceable in accordance with the law of the jurisdiction in which Company's specific office issuing the Proposal is located. Such location shall be deemed the place of contracting.

The provisions of these Terms and Conditions are severable. The invalidity of any part of these Terms and Conditions shall not invalidate the remainder of these Terms and Conditions nor the remainder of any portion hereof.

These printed terms and conditions cannot be modified orally or by any course of conduct. Any modification must be acknowledged in writing by Company. These conditions shall take precedence over any inconsistent or contradictory provisions contained in any proposal, contract, purchase order, requisition, notice to proceed, or like document issued by Client. Client shall not assign any aspect of the agreement between Client and Company except upon the prior written consent of Company.

Section 14. Third Party Indemnity. Client agrees that Company has neither created nor contributed to the creation of any hazardous materials, pollutants, asbestos, or other potentially dangerous substance that is now or may be in the future discovered or introduced at the Site. Company hereby states, and Client acknowledges by acceptance of the Proposal, that Company may not have any professional liability or other coverage insuring Company for acts, errors and omissions, and Company may be unable to obtain such insurance at reasonable cost, for claims arising out of the performance of services, including but not limited to, investigation, assessment or evaluation of hazardous materials or pollutants or the detection, abatement, removal or replacement of products, materials or processes containing asbestos.

Client agrees to defend, indemnify and hold harmless Company, its subcontractors, consultants, agents, officers, directors, and employees harmless from and against any and all claims for damages and all costs, liability or expense, whether direct, indirect, economic, or consequential, including reasonable attorneys' fees, and court and arbitration costs, sustained or alleged by any person or entity other than Client, based upon or arising in connection with: 1) a release of hazardous materials or pollutants; 2) bodily injury including death and property damage (real or personal) or any other claim of damage, expense or loss, caused by the release, removal, remediation, assessment, evaluation or investigation of hazardous materials or pollutants; 3) removal, assessment, evaluation or investigation of, or remedial action taken because of, the release or suspected release of hazardous materials or pollutants; 4) any federal, state, local or other governmental fines or penalties related to hazardous materials or pollutants; or 5) the detection, abatement, removal, or replacement of products, materials, or processes containing asbestos.

Section 15. Limitation of Professional Liability.

(a) **General** - Client agrees that Company's liability to Client based upon or arising out of Company's alleged breach of contract or negligent professional acts, errors or omissions is limited, in amount, to the aggregate sum of \$50,000 or Company's aggregate fee for services rendered on the subject project, whichever amount is greater.

(b) **Construction Projects** - Client agrees that Company's liability to Client and to any and all construction contractors and subcontractors for the project based upon claims arising as a result of Company's alleged breach of contract or negligent professional acts, errors or omissions is limited to the aggregate sum of \$50,000 or Company's aggregate fee for services rendered on the subject project, whichever is greater.

(c) **Increased Limit of Professional Liability** - Company, upon Client's written request, agrees to increase the limit of Company's liability for breach of contract or negligent professional acts, errors or omissions in consideration of additional payment by Client or other consideration deemed appropriate by Company at the time. The request for increased limit of professional liability must be made to Company in writing at the time of Client's acceptance of the Proposal.

Client may indicate a requested limit of liability by initialing and dating in the appropriate spaces below.

<u>Limit of Liability</u>	<u>Additional Fee</u>	<u>Initials</u>	<u>Date</u>
\$50,000	none	_____	_____
\$75,000	\$1,000	_____	_____
\$100,000	\$2,000	_____	_____

Any additional fee is due at the time of Client's request, and the increased limit of liability will become effective upon payment of the fee and execution of the Proposal. Additional monetary or other consideration given by Client for the additional economic risk assumed by Company shall not be construed as a charge for the placement or provision of additional professional liability insurance by Company.

GZA GeoEnvironmental, Inc.
Equal Opportunity - Affirmative Action Employer
M/F/V/H

APPENDIX B

BORING LOGS

GZA GEO ENVIRONMENTAL, INC. 140 BROADWAY, PROVIDENCE, RHODE ISLAND GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS				PROJECT TANK #5, NAVY SUB BASE Groton, CT		REPORT OF BORING No. GZ-1 SHEET 1 OF 1 FILE No. Y-30894 CHKD. BY HDF																					
BORING Co. GZA Drilling, Inc. FOREMAN Paul Wordell GZA ENGINEER William Ladd		BORING LOCATION See Exploration Location Plan GROUND SURFACE ELEVATION 22.0 DATUM MSL DATE START 10-29-91 DATE END 10-29-91																									
SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in. CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 lb. HAMMER FALLING 24 in. CASING SIZE: OTHER: 3 3/4" Hollow Stem Augers				<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="5">GROUNDWATER READINGS</th> </tr> <tr> <th>DATE</th> <th>TIME</th> <th>WATER</th> <th>CASING</th> <th>STABIL. TIME</th> </tr> <tr> <td>10-29-91</td> <td></td> <td>5.7'</td> <td>10' (Remov)</td> <td>10 minutes</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>				GROUNDWATER READINGS					DATE	TIME	WATER	CASING	STABIL. TIME	10-29-91		5.7'	10' (Remov)	10 minutes					
GROUNDWATER READINGS																											
DATE	TIME	WATER	CASING	STABIL. TIME																							
10-29-91		5.7'	10' (Remov)	10 minutes																							
DEPTH H	C B A L S O N W G S	SAMPLE			SAMPLE DESCRIPTION		RE M K S	STRATUM DESCRIPTION																			
		No.	PEN./ REC	DEPTH (Ft.)	BLOWS/6"	Burmister CLASSIFICATION																					
5		S-1A	24/6	0-2	3-9	S-1A: Dark brown, fine SAND and SILT, Organic, little roots (TOPSOIL) S-1B: Medium dense, tan, fine(+) to medium SAND, trace(+) Silt, trace fine to coarse Gravel (fractured). Dry.		TOPSOIL																			
		S-1B	24/9		9-11																						
10		S-2	24/12	5-7	1/12"	Very loose, tan, fine(+) to medium SAND, little Silt. Soil in tip of sampler was darker gray in color and contained some Organic Silt, trace fibrous roots. Saturated.		GRANULAR FILL																			
					1-1																						
15		S-3	24/8	10-12	3-3	Loose, tan to gray, fine(+) to medium SAND, little to some Silt, trace fine Gravel, one small piece of non-woven fabric. Organic Odor. Fill																					
					5-10																						
20		S-4	24/20	15-17	1/12"	Very loose, gray, fine SAND and Organic Silt, trace(-) coarse Sand, trace woody roots. Possibly Natural.		1. 18'±																			
					1-1																						
25		S-5A	24/5	20-22	18-23	S-5A: Yellow-brown, fine SAND and Silt		NATURAL STRATIFIED SANDS																			
		S-5B	24/8		16-15	S-5B: White with black mica flecks, fine to medium(+) SAND, trace(-) Silt. Stratified.																					
30						Bottom of Boring at 22'		22'																			
		GRANULAR SOILS Blows/Ft Density		COHESIVE SOILS Blows/Ft Density		REMARKS: 1. Augers grinding slightly at 18'+.																					
		0- 4 V. LOOSE 4-10 LOOSE 10-30 M. DENSE 30-50 DENSE > 50 V. DENSE		< 2 V. SOFT 2- 4 SOFT 4- 8 M. STIFF 8-15 STIFF 15-30 V. STIFF > 30 HARD																							
NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL. 2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED, FLUCTUATIONS OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE																											
GZA								BORING No. GZ-1																			

GZA GEO ENVIRONMENTAL, INC. 140 BROADWAY, PROVIDENCE, RHODE ISLAND GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS				PROJECT TANK #5, NAVY SUB BASE Groton, CT		REPORT OF BORING No. GZ-2 SHEET 1 OF 1 FILE No. Y-30894 CHKD. BY HDF																					
BORING Co. GZA Drilling, Inc. FOREMAN Paul Wordell GZA ENGINEER William Ladd		BORING LOCATION See Exploration Location Plan GROUND SURFACE ELEVATION 22.5 DATUM MSL DATE START 10-29-91 DATE END 10-29-91																									
SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 In. CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 lb. HAMMER FALLING 24 In. CASING SIZE: OTHER: 3 3/4" Hollow Stem Augers				<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="5">GROUNDWATER READINGS</th> </tr> <tr> <th>DATE</th> <th>TIME</th> <th>WATER</th> <th>CASING</th> <th>STABIL. TIME</th> </tr> <tr> <td>10-29-91</td> <td></td> <td>6.5'</td> <td>10' (Remov)</td> <td>15 minutes</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>				GROUNDWATER READINGS					DATE	TIME	WATER	CASING	STABIL. TIME	10-29-91		6.5'	10' (Remov)	15 minutes					
GROUNDWATER READINGS																											
DATE	TIME	WATER	CASING	STABIL. TIME																							
10-29-91		6.5'	10' (Remov)	15 minutes																							
DEPTH H	CORRECTION B L A L S O N W G S	SAMPLE <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>No.</th> <th>PEN./REC</th> <th>DEPTH (Ft.)</th> <th>BLOWS/6"</th> </tr> </table>			No.	PEN./REC	DEPTH (Ft.)	BLOWS/6"	SAMPLE DESCRIPTION Burmister CLASSIFICATION		REMARKS	STRATUM DESCRIPTION															
No.	PEN./REC	DEPTH (Ft.)	BLOWS/6"																								
		S-1A	24/9	0-2	3-6	S-1A: Dark brown, fine to medium SAND and Silt, little roots, Organic. TOPSOIL. S-1B: Orange-brown, fine to coarse(-) SAND, some fine Gravel, trace Silt		TOPSOIL -----																			
		S-1B	24/10		8-12																						
5		S-2	24/7	5-7	7-5	Loose, gray, fine SAND, some Silt, trace fine Gravel. Saturated.	1.	GRANULAR FILL																			
					3-2																						
10		S-3	24/16	10-12	5-2	Very loose, gray, fine SAND, some Silt, trace(-) fine Gravel.																					
					2-3																						
15		S-4	24/18	15-17	1-2	Very loose, gray, fine SAND and Silt, trace coarse Sand, fine Gravel, trace(-) fibrous roots.																					
					2-3																						
20		S-5	18/18	20-21.5	10-17	Very dense, brown, medium to coarse SAND, changing to orange-brown, fine to coarse SAND, trace Silt, with 2" zone of gray, fine SAND, some Silt.	22'	STRATIFIED SANDS -----																			
					48-Ref																						
25		Bottom of Boring at 22'																									
30																											
GRANULAR SOILS Blows/Ft Density		COHESIVE SOILS Blows/Ft Density		REMARKS: 1. Augers grinding at 7 to 8'+.																							
0-4 V. LOOSE 4-10 LOOSE 10-30 M. DENSE 30-50 DENSE > 50 V. DENSE		< 2 V. SOFT 2-4 SOFT 4-8 M. STIFF 8-15 STIFF 15-30 V. STIFF > 30 HARD																									
NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL. 2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED, FLUCTUATIONS OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE																											
GZA							BORING No. GZ-2																				

GZA GEO ENVIRONMENTAL, INC. 140 BROADWAY, PROVIDENCE, RHODE ISLAND GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS				PROJECT TANK #5, NAVY SUB BASE Groton, CT		REPORT OF BORING No. GZ-3 SHEET 1 OF 1 FILE No. Y-30894 CHKD. BY HDF	
BORING Co. GZA Drilling, Inc. FOREMAN Paul Wordell GZA ENGINEER William Ladd		BORING LOCATION See Exploration Location Plan GROUND SURFACE ELEVATION 23.8 DATUM MSL DATE START 10-29-91 DATE END 10-29-91					
SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 in. CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 lb. HAMMER FALLING 24 in. CASING SIZE: OTHER: 3 3/4" Hollow Stem Augers				GROUNDWATER READINGS			
				DATE	TIME	WATER	CASING
				10-29-91		7.5'	10' (Remov)
							STABIL. TIME 10 minutes

DEPTH	CORRECTION	BLOW COUNT	SAMPLE			SAMPLE DESCRIPTION <u>Burmister</u> CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
			No.	PEN./REC	DEPTH (Ft.)			
5		S-1	24/20	0-2	4-7	Medium dense, light brown, fine to medium SAND, some fine Gravel, trace(+) Silt.		GRANULAR FILL
					7-6			
10		S-2	24/16	5-7	1-1/12"	Very loose, brown, fine(+) to medium SAND, little Silt, trace coarse Sand. Wet at bottom.		GRANULAR FILL
					3			
15		S-3	24/22	10-12	1/12"	Very loose, light brown, fine(+) to medium SAND, little Silt, trace coarse Sand	1.	NATURAL SOILS
					1-1			
20		S-4	1/0	15-15.1	50/1"	No Recovery	14'±	NATURAL SOILS
25		S-5	0/0		50/0	No Recovery	20'	NATURAL SOILS
30						Bottom of Boring at 20'		

GRANULAR SOILS Blows/Ft Density	COHESIVE SOILS Blows/Ft Density	REMARKS: 1. Auger grinding occasionally.
0- 4 V. LOOSE 4-10 M. LOOSE 10-30 M. DENSE 30-50 DENSE > 50 V. DENSE	< 2 V. SOFT 2- 4 SOFT 4- 8 M. STIFF 8-15 STIFF 15-30 V. STIFF > 30 HARD	

NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
 2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED, FLUCTUATIONS OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE

BORING No. GZ-3

GZA GEO ENVIRONMENTAL, INC. 140 BROADWAY, PROVIDENCE, RHODE ISLAND						PROJECT <u>TANK #5, NAVY SUB BASE</u> <u>Groton, CT</u>			REPORT OF BORING No. GZ-4 SHEET <u>1</u> OF <u>1</u> FILE No. Y-30894 CHKD. BY HDF		
GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS											
BORING Co.		<u>GZA Drilling, Inc.</u>		BORING LOCATION See Exploration Location Plan							
FOREMAN		<u>Paul Worrell</u>		GROUND SURFACE ELEVATION <u>22.7</u>			DATUM <u>MSL</u>				
GZA ENGINEER		<u>William Ladd</u>		DATE START <u>10-29-91</u>			DATE END <u>10-29-91</u>				
SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 In.						GROUNDWATER READINGS					
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 lb. HAMMER FALLING 24 In.						DATE	TIME	WATER	CASING	STABIL. TIME	
						10-29-91		8.2'	10' (Remov)	15 minutes	
CASING SIZE: OTHER: 3 3/4" Hollow Stem Augers											
D E P T H	C B A L S O N W G S	No.	PEN./ REC	DEPTH (Ft.)	BLOWS/6"	SAMPLE DESCRIPTION <u>Burmister CLASSIFICATION</u>	R E M K S	STRATUM DESCRIPTION			
5	s-1	24/20	0-2	15-34		Very dense, light brown, fine to coarse SAND, some fine to coarse Gravel, trace silt. 2" Topsoil at top of sample. Slight petroleum odor	1.	SAND AND GRAVEL FILL			
				13-28							
10	s-2	24/11	5-7	3-4		Loose, light gray, fine(+) to medium SAND, trace fractured rock, little silt. Slight petroleum odor. Wet at bottom	1.	GRANULAR FILL			
				2-2							
15	s-3	24/18	10-12	1-2		Loose, gray, fine(+) to medium SAND, some silt, trace(-) coarse Sand					
				3-2							
20	s-4	24/18	15-17	WOR/12"		Very loose, gray, fine SAND and SILT, trace(-) fine Gravel	2.	STRATIFIED SAND AND SILT			
				1/12"							
25	s-5A	24/7	20-22	3-8		S-5A: Brown, medium to coarse SAND, little fine Gravel S-5B: Yellow-brown SILT, little fine Sand	2.2				
	s-5B	24/8		11-11							
30						Bottom of Boring at 22'					
GRANULAR SOILS Blows/Ft Density			COHESIVE SOILS Blows/Ft Density			REMARKS:					
0- 4 V. LOOSE	< 2 V. SOFT	1. Sample had slight petroleum odor.									
4-10 LOOSE	2- 4 SOFT	2. "WOR" indicates "weight of rods".									
10-30 M. DENSE	4- 8 M. STIFF										
30-50 DENSE	8-15 STIFF										
> 50 V. DENSE	15-30 V. STIFF										
	> 30 HARD										
NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.											
2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED, FLUCTUATIONS OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE											
GZA			BORING No. GZ-4								

APPENDIX C
CHEMICAL SCREENING & ANALYSES

GC SCREENING

JOB DESCRIPTION: TANK NO. 5 NAVY SUB BASE – GROTON, CT
 JOB #: 30894
 DATE SAMPLED: 10/29/91
 DATE TESTED: 10/31/91

GZA GEOENVIRONMENTAL, INC.
 320 NEEDHAM STREET
 NEWTON UPPER FALLS, MA 02164
 (617) 969-0050, x-289
 LAB I.D. No.: MA092

GZA GC SCREENING FOR VOLATILE ORGANICS IN SOILS
 (CONCENTRATION – PPB, ug/kg of wet soil)

SAMPLE NAME: GZA LAB #:	Method Blank 07393-B	GZ-1 S-3 3R393-S	GZ-1 S-5B 3R394-S	GZ-2 S-5 3R395-S	GZ-3 S-2 37396-S	GZ-4 S-1 37397-S	METHOD DETECTION LIMIT
1. TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	20
2. TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	10
3. 1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	10
4. TOTAL 1,2-DICHLOROETHENES	ND	ND	ND	ND	ND	ND	10
5. METHYLENE CHLORIDE	ND	ND	ND	ND	ND	ND	20
6. VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	20
7. 1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	20
8. 1,1-DICHLOROETHANE	ND	ND	ND	ND	ND	ND	10
9. 1,2-DICHLOROETHANE	ND	ND	ND	ND	ND	ND	10
10. CHLOROETHANE	ND	ND	ND	ND	ND	ND	10
11. METHYL-t-BUTYL ETHER	ND	ND	ND	ND	ND	ND	10
12. BENZENE	ND	ND	ND	ND	ND	ND	10
13. TOLUENE	ND	ND	ND	ND	ND	ND	10
14. ETHYL BENZENE	ND	ND	ND	ND	ND	ND	10
15. m,p-XYLENES	ND	ND	ND	ND	ND	ND	20
16. o-XYLENE	ND	ND	ND	ND	ND	ND	20
17. ACETONE	ND	ND	ND	ND	ND	ND	10
18. METHYL ETHYL KETONE	ND	ND	ND	ND	ND	ND	10
19. METHYL ISOBUTYL KETONE	ND	ND	ND	ND	ND	ND	10
20. CHLOROFORM	ND	ND	ND	ND	ND	ND	40
21. FREON 113 (CCl3-CF3)	ND	ND	ND	ND	ND	ND	30
22. CHLOROBENZENE	ND	ND	ND	ND	ND	ND	20
23. STYRENE	ND	ND	ND	ND	ND	ND	30
TOTAL COMPOUNDS (1-23)	ND	ND	ND	ND	ND	ND	
METHANE (V/V-air, PPM)	ND	ND	ND	ND	ND	ND	10 PPM
UNKNOWN(S) (#)	ND	(39)	ND	ND	(1)	(18)	

COMMENTS: A trace level of one (1) early eluting unknown compound, which can be tentatively identified as methanol, was detected in samples GZ-3, S-2 and GZ-4, S-1. Methanol is a laboratory artifact that is inherent to this method and is most likely not present in samples GZ-3, S-2 and GZ-4, S-1. The pattern of the chromatograms for samples GZ-1, S-3 and GZ-4, S-1 indicates the presence of an unknown petroleum distillate such as a fuel oil. Results are reported with two (2) significant digits.

ANALYZED BY

R. Soukup

REVIEWED BY

J. Blackwell

JOB DESCRIPTION: TANK NO. 5 NAVY SUB BASE - GROTON, CT
 JOB #: 30894
 DATE SAMPLED: 10/29/91
 DATE TESTED: 10/31/91

GZA GEOENVIRONMENTAL, INC.
 320 NEEDHAM STREET
 NEWTON UPPER FALLS, MA 02164
 (617) 969-0050, x-289
 LAB I.D. No.: MA092

GZA GC SCREENING FOR VOLATILE ORGANICS IN SOILS
 (CONCENTRATION - PPB, ug/kg of wet soil)

SAMPLE NAME:	Method	GZ-4					METHOD
GZA LAB #:	Blank	S-2					DETECTION
	07393-B	37398-S					LIMIT
1. TETRACHLOROETHENE	ND	ND					20
2. TRICHLOROETHENE	ND	ND					10
3. 1,1-DICHLOROETHENE	ND	ND					10
4. TOTAL 1,2-DICHLOROETHENES	ND	ND					10
5. METHYLENE CHLORIDE	ND	ND					20
6. VINYL CHLORIDE	ND	ND					20
7. 1,1,1-TRICHLOROETHANE	ND	ND					20
8. 1,1-DICHLOROETHANE	ND	ND					10
9. 1,2-DICHLOROETHANE	ND	ND					10
10. CHLOROETHANE	ND	ND					10
11. METHYL-t-BUTYL ETHER	ND	ND					10
12. BENZENE	ND	ND					10
13. TOLUENE	ND	ND					10
14. ETHYL BENZENE	ND	ND					10
15. m,p-XYLENES	ND	ND					20
16. o-XYLENE	ND	ND					20
17. ACETONE	ND	ND					10
18. METHYL ETHYL KETONE	ND	ND					10
19. METHYL ISOBUTYL KETONE	ND	ND					10
20. CHLOROFORM	ND	ND					40
21. FREON 113 (CCI3-CH3)	ND	ND					30
22. CHLOROBENZENE	ND	ND					20
23. STYRENE	ND	ND					30
TOTAL COMPOUNDS (1-23)	ND	ND					
METHANE (V/V-air, PPM)	ND	ND					10 PPM
UNKNOWN(S) (#)	ND	(4)					

COMMENTS: A trace level of one (1) early eluting unknown compound, which can be tentatively identified as methanol, was detected in sample GZ-4, S-2. Trace levels of three (3) variously eluting unknown compounds were detected in sample GZ-4, S-2. Methanol is a laboratory artifact that is inherent to this method and is most likely not present in sample GZ-4, S-2. Results are reported with two (2) significant digits.

ANALYZED BY *R. Bowker*

REVIEWED BY *J. Blackwell*

GZA RAPID VOLATILE ORGANIC SCREENING OF SOIL SAMPLES BY THE STATIC HEADSPACE TECHNIQUE

SAMPLE PREPARATION AND ANALYTICAL METHODOLOGY

OVERVIEW

The GZA rapid screening technique for volatile organics in soil estimates concentrations of these compounds from gaseous concentrations measured in air above the sample. The method measures concentrations of contaminants released from the soil samples into the headspace. This method has been developed by the GZA Environmental Chemistry Laboratory to provide rapid and cost effective screening of soil samples for volatile organics. Although, this technique is a modification of EPA Method 3810, it is not definitive and is not approved by the EPA for certification purposes.

METHODOLOGY

Soil samples taken in the field are placed in 250 ml glass jars with a teflon gasket lid. The samples are kept at 4 degrees C until the time of analysis. A 10 ml crimp top septum vial is marked and tared with a crimp top on an analytical balance. A subsample of soil is added until all but a 2.5 ml volume of headspace remains. The vial cap is immediately crimped on and the weight of the vial and its contents is again measured to determine the weight of soil added. A 1.0 ml aliquot of headspace gas is withdrawn automatically by a Hewlett Packard 19395A headspace injector. The headspace sample is injected into the sample port of a HP 5890A gas chromatograph where the vapor is split within the injection port and distributed to two 30 meter X 530 micron fused silica capillary columns. Concentrations of eluting volatile organics are measured with dual flame ionization detectors and response data are acquired by a Nelson Analytical 760 Series Intelligent Interface. The chromatographic data are transmitted to an IBM AT personal computer and analyzed using the Nelson Analytical 2600 Series Chromatography Software. The information for the analytical report is entered manually onto a Lotus Symphony spreadsheet.

CALIBRATION

The response of the gas chromatograph is calibrated with external standards prepared for concentrations of 0.1, 1.0, and 10 ug/g (ppm) on a mass response basis and introduced into the chromatograph as headspace samples in the same manner as unknown soil samples. Sample peaks are identified by comparing their retention times from both columns to measured retention times of calibration standards for both columns. Qualitative comparisons are made between the two sets of test data for each sample. Sample peaks identified as known compounds are quantified according to response factors determined from calibration standards.

REPORT FORMAT

The method detection limit (MDL) for each compound is stated for every report with 95% certainty in an average chromatographic run. The method quantitation limit (MQL) is considered to be 5 times the MDL. Concentrations measured in the range of 1 to 5 times the MDL are reported as "Trace". Concentrations less than the MDL may be identified as beneath the method detection limit (BMDL) in instances where the compound's presence is 95% certain in that particular chromatogram. The total concentration for all detected compounds for which a calibration has been made, except methane, is summarized in the row designated as "Total Compounds"; none detected, ND, is reported if no known peaks are found. Unidentifiable peaks are reported as the number of unknown peaks are reported in parentheses. Compounds not detected are reported as "ND".

QUALITY CONTROL

The GZA procedure assumes that response factors are constant over the working range of 10 ppb to 10 ppm and that the precision of the analysis for samples is the same as that for the calibration standards. The 95% confidence limits for a measurement are defined as plus or minus two standard deviations as determined by a Student's t Test on replicate analyses of calibration standards. Quality control standards are analyzed daily and accepted if the relative standard deviation of the response factor is less than 20% of the anticipated value. New calibration curves are prepared when quality control limits are exceeded. Method blanks are prepared in the same manner as samples and are analyzed before each job or no less frequently than every ten samples. Field blanks and trip blanks are submitted at the discretion of the sample submitter. Matrix spikes and duplicate analyses are performed at a frequency of not less than one per twenty or fewer samples and results are reported as matrix spike recoveries and percent differences. Analytical results are not blank corrected.

DISCLAIMER

Identities and concentrations of volatile organic compounds reported by this headspace screening technique are subject to limitations inherent to this method. Chromatographic data are quantified by response factors that assume 100% volatilization of sorbed organic compounds into the headspace. Therefore, the reported concentrations probably represent the lower limits of contamination. If confirmation is desired, duplicate samples should be submitted to a State certified laboratory for analysis by the appropriate EPA protocol methods.

LABORATORY SAMPLE NOTATION:

S - Solid B - Blank

LABORATORY CONTACT PERSON:

Edward W. Pickering, Manager
Environmental Chemistry Laboratory
GZA GeoEnvironmental, Inc.
Massachusetts Laboratory I.D. No. MA092
Phone #: (617) 969-0050, x169

REFERENCES

Commonwealth of Massachusetts DEP, "Minimum Standards for Analytical Data for Remedial Response Actions Under M.G.L. c. 21E", Policy #WSC-89-004 (1990).

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July 1991/EWP-DM

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MASSACHUSETTS LABORATORY I.D. NO. MA092

GZA GAS CHROMATOGRAPHIC SCREENING FOR VOLATILE ORGANICS
IN AQUEOUS AND/OR SOLID MATRIX
QUALITY CONTROL

DATE: 10/30/91

AQUEOUS

COMPOUNDS	MATRIX SPIKE RECOVERY (%)	ACCEPTANCE LIMITS (%)	DUPLICATE SPIKE PERCENT DIFFERENCE (%)	ACCEPTANCE LIMITS (%)
Trichloroethene	100	70-130	2	35
Toluene	96.5	70-130	0.1	35

SOLID

COMPOUNDS	MATRIX SPIKE RECOVERY (%)	ACCEPTANCE LIMITS (%)	DUPLICATE SPIKE PERCENT DIFFERENCE (%)	ACCEPTANCE LIMITS (%)
Trichloroethene	---	70-130	---	35
Toluene	---	70-130	---	35

TPH ANALYSIS

GZA GEOENVIRONMENTAL, INC.
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EPA METHOD 418.1 PETROLEUM HYDROCARBONS
(SPECTROPHOTOMETRIC, INFRARED)
PHC-IR
CONCENTRATION (PPM, ug/g or ug/ml)

JOB DESCRIPTION: TANK #5 - GROTON, CT
JOB #: 30894
DATE SAMPLED: 10/29/91
DATE TESTED: 11/07/91

SAMPLE NAME:	METHOD BLANK	GZ-4
GZA LAB #:	110791-QC	S-2 02042-IR
1. HYDROCARBON CONTENT	<10	380
2. PERCENT SOLID CONTENT	N/A	88%
3. MATRIX	N/A	SOIL
4. DETECTION LIMIT	10	10

COMMENTS: .

ANALYZED BY:

J. Faulkner

REVIEWED BY:

L. Wain

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EPA METHOD 418.1 PETROLEUM HYDROCARBONS
(SPECTROPHOTOMETRIC, INFRARED)
PHC-IR
CONCENTRATION (PPM, ug/g or ug/ml)

JOB DESCRIPTION: TANK #5 - GROTON, CT
JOB #: 30894
DATE SAMPLED: 10/29/91
DATE TESTED: 11/07/91

SAMPLE NAME:	METHOD BLANK	GZ-1
GZA LAB #:	110791-QC	S-3
		02040-IR
1. HYDROCARBON CONTENT	<10	590
2. PERCENT SOLID CONTENT	N/A	85%
3. MATRIX	N/A	SOIL
4. DETECTION LIMIT	10	10

COMMENTS:

ANALYZED BY:

J. Faulkner

REVIEWED BY:

K. Walsh

GZA GEOENVIRONMENTAL, INC.
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EPA METHOD 418.1 PETROLEUM HYDROCARBONS
(SPECTROPHOTOMETRIC, INFRARED)
PHC-IR
CONCENTRATION (PPM, ug/g or ug/ml)

JOB DESCRIPTION: TANK #5 - GROTON, CT
JOB #: 30894
DATE SAMPLED: 10/29/91
DATE TESTED: 11/07/91

SAMPLE NAME:	METHOD BLANK	GZ-4
GZA LAB #:	110791-QC	S-1 02041-IR
1. HYDROCARBON CONTENT	<10	9,200
2. PERCENT SOLID CONTENT	N/A	93%
3. MATRIX	N/A	SOIL
4. DETECTION LIMIT	10	10

COMMENTS: .

ANALYZED BY:

J. Funchner

REVIEWED BY:

L. Walsh

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HYDROCARBON FINGERPRINTING
MODIFIED ASTM METHOD D3328
CONCENTRATION (PPM-ug/g or ug/ml)

JOB DESCRIPTION: TANK NO. 5 - GROTON, CT
JOB #: 30894
DATE SAMPLED: 10/29/91
DATE TESTED: 11/8/91

SAMPLE NAME: GZA LAB #:	METHOD BLANK 110891-QC	S-1 03371-PHC
1. HYDROCARBON CONTENT	<10	110,000
2. PERCENT SOLID CONTENT	N/A	N/A
3. MATRIX	N/A	OIL
4. DETECTION LIMIT (TOTAL PRODUCT)	10	10,000
5. DETECTION LIMIT (INDIVIDUAL HYDROCARBONS)	0.5	500
6. SURROGATE RECOVERY (O-TERPHENYL)	103%	DILUTED OUT

QUALITATIVE IDENTIFICATION: N/A

ANALYZED BY:

[Signature]

REVIEWED BY:

[Signature]

GZA GEOENVIRONMENTAL, INC.
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(617) 969-0050
MASSACHUSETTS LABORATORY I.D. NO. MA092

HYDROCARBON FINGERPRINTING
MODIFIED ASTM METHOD D3328
CONCENTRATION (PPM-ug/g or ug/ml)

JOB DESCRIPTION: TANK NO. 5 - GROTON, CT
JOB #: 30894
DATE SAMPLED: 10/29/91
DATE TESTED: 11/8/91

SAMPLE NAME:	METHOD	S-2
GZA LAB #:	BLANK 110891-QC	03373-PHC
1. HYDROCARBON CONTENT	<10	280,000
2. PERCENT SOLID CONTENT	N/A	N/A
3. MATRIX	N/A	OIL
4. DETECTION LIMIT (TOTAL PRODUCT)	10	10,000
5. DETECTION LIMIT (INDIVIDUAL HYDROCARBONS)	0.5	500
6. SURROGATE RECOVERY (O-TERPHENYL)	103%	DILUTED OUT

QUALITATIVE IDENTIFICATION: N/A

ANALYZED BY:

y. Faulkner

REVIEWED BY:

K. Walsh

GZA GEOENVIRONMENTAL, INC.
ENVIRONMENTAL CHEMISTRY LABORATORY
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164
(617) 969-0050
MASSACHUSETTS LABORATORY I.D. NO. MA092

HYDROCARBON FINGERPRINTING
MODIFIED ASTM METHOD D3328
CONCENTRATION (PPM-ug/g or ug/ml)

JOB DESCRIPTION: TANK NO. 5 - GROTON, CT
JOB #: 30894
DATE SAMPLED: 10/29/91
DATE TESTED: 11/8/91

SAMPLE NAME: GZA LAB #:	METHOD BLANK 110891-QC	S-1A 03375-PHC
1. HYDROCARBON CONTENT	<10	540,000
2. PERCENT SOLID CONTENT	N/A	N/A
3. MATRIX	N/A	OIL
4. DETECTION LIMIT (TOTAL PRODUCT)	10	10,000
5. DETECTION LIMIT (INDIVIDUAL HYDROCARBONS)	0.5	500
6. SURROGATE RECOVERY (O-TERPHENYL)	103%	DILUTED OUT

QUALITATIVE IDENTIFICATION: N/A

ANALYZED BY:

J. Faulkner

REVIEWED BY:

K. Walsh

PETROLEUM HYDROCARBON FINGERPRINTING

GZA GEOENVIRONMENTAL, INC.
ENVIRONMENTAL CHEMISTRY LABORATORY
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164
(617) 969-0050
MASSACHUSETTS LABORATORY I.D. NO. MA092

HYDROCARBON FINGERPRINTING
MODIFIED ASTM METHOD D3328
CONCENTRATION (PPM-ug/g or ug/ml)

JOB DESCRIPTION: TANK NO. 5 - GROTON, CT
JOB #: 30894
DATE SAMPLED: 10/29/91
DATE TESTED: 11/8/91

SAMPLE NAME:	METHOD	GZ-1, S-3
GZA LAB #:	BLANK	
	110891-QC	03369-FP
1. HYDROCARBON CONTENT	<10	36
2. PERCENT SOLID CONTENT	N/A	85%
3. MATRIX	N/A	SOIL
4. DETECTION LIMIT (TOTAL PRODUCT)	10	10
5. DETECTION LIMIT (INDIVIDUAL HYDROCARBONS)	0.5	0.5
6. SURROGATE RECOVERY (O-TERPHENYL)	103%	90%

QUALITATIVE IDENTIFICATION:

The characteristics of the chromatogram for sample "GZ-1, S-3" indicate the presence of two petroleum products. The first petroleum product is in the boiling range of fuel oil #4, constitutes approximately 75% of the hydrocarbon content, and has a phytane/n-C18 ratio of greater than 10 which indicates severe weathering has occurred. The second petroleum product is in the boiling range of fuel oil #6 and constitutes approximately 25% of the hydrocarbon content.

ANALYZED BY:

J. Faulkner

REVIEWED BY:

K. Wall

GZA GEOENVIRONMENTAL, INC.
ENVIRONMENTAL CHEMISTRY LABORATORY
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164
(617) 969-0050
MASSACHUSETTS LABORATORY I.D. NO. MA092

HYDROCARBON FINGERPRINTING
MODIFIED ASTM METHOD D3328
CONCENTRATION (PPM-ug/g or ug/ml)

JOB DESCRIPTION: TANK NO. 5 - GROTON, CT
JOB #: 30894
DATE SAMPLED: 10/29/91
DATE TESTED: 11/8/91

SAMPLE NAME:	METHOD BLANK	GZ-4, S-1
GZA LAB #:	110891-QC	03370-FP
1. HYDROCARBON CONTENT	<10	440
2. PERCENT SOLID CONTENT	N/A	93%
3. MATRIX	N/A	SOIL
4. DETECTION LIMIT (TOTAL PRODUCT)	10	10
5. DETECTION LIMIT (INDIVIDUAL HYDROCARBONS)	0.5	0.5
6. SURROGATE RECOVERY (O-TERPHENYL)	103%	102%

QUALITATIVE IDENTIFICATION:

The characteristics of the chromatogram for sample "GZ-4, S-1" indicate the presence of two petroleum products. The first petroleum product is in the boiling range of fuel oil #4, constitutes approximately 50% of the hydrocarbon content, and has a phytane/n-C18 ratio of 7.3 which indicates that moderate weathering has occurred. The second petroleum product is in the boiling range of fuel oil #6 and constitutes approximately 50% of the hydrocarbon content.

ANALYZED BY: *J. Faulkner*

REVIEWED BY: *L. Walsh*

PCB/PESTICIDE ANALYSIS

GZA GEOENVIRONMENTAL, INC.
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164
(617) 969-0050

EPA 8080 ANALYSIS
PCB's/PESTICIDES SCREENING

JOB DESCRIPTION: TANK #5 - GROTON, MA
JOB #: 30894 DATE SAMPLED: 11/02/91
SAMPLE #: S-1 DATE TESTED: 11/08/91
LABORATORY #: 22391 - PCB/PEST DILUTION FACTOR: 50

PCB'S

8080 COMPOUNDS: POLYCHLORINATED BIPHENYLS	CONCENTRATION ug/kg-Oil (PPB)	DETECTION LIMIT ug/kg-Oil (PPB)
AROCLOR 1260	--36,000--	2,500
AROCLOR 1254	ND	2,500
AROCLOR 1248	ND	2,500
AROCLOR 1242/1016	ND	2,500
AROCLOR 1232	ND	2,500
AROCLOR 1221	ND	2,500

PESTICIDES

8080 COMPOUNDS: PESTICIDES	CONCENTRATION ug/kg-Oil (PPB)	DETECTION LIMIT ug/kg-Oil (PPB)
ALPHA - BHC	--2,800--	250
GAMMA - BHC	ND	250
BETA - BHC	ND	250
HEPTACHLOR	ND	250
DELTA - BHC	--800--	250
ALDRIN	ND	250
HEPTACHLOR EPOXIDE	--850--	250
ENDOSULFAN I	ND	250
4,4'-DDE	ND	250
DIELDRIN	ND	250
ENDRIN	ND	250
4,4'-DDD	ND	250
ENDOSULFAN II	ND	250
4,4'-DDT	ND	250
ENDRIN ALDEHYDE	ND	250
ENDOSULFAN SULFATE	ND	250
METHOXYCHLOR	ND	2,500
TOXAPHENE	ND	2,500
CHLORDANE	ND	2,500

COMMENTS:

ANALYZED BY:

VL

J. Faulkner

REVIEWED BY:

KW

K. W. L. L. L.

GZA GEOENVIRONMENTAL, INC.
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164
(617) 969-0050

EPA 8080 ANALYSIS
PCB'S/PESTICIDES SCREENING

JOB DESCRIPTION: TANK #5 - GROTON, MA

JOB #: 30894

DATE SAMPLED: 11/02/91

SAMPLE #: S-1A

DATE TESTED: 11/08/91

LABORATORY #: 22392 - PCB/PEST

DILUTION FACTOR: 50

PCB'S

8080 COMPOUNDS: POLYCHLORINATED BIPHENYLS	CONCENTRATION ug/kg-Oil (PPB)	DETECTION LIMIT ug/kg-Oil (PPB)
AROCLOR 1260	--57,000--	2,500
AROCLOR 1254	ND	2,500
AROCLOR 1248	ND	2,500
AROCLOR 1242/1016	ND	2,500
AROCLOR 1232	ND	2,500
AROCLOR 1221	ND	2,500

PESTICIDES

8080 COMPOUNDS: PESTICIDES	CONCENTRATION ug/kg-Oil (PPB)	DETECTION LIMIT ug/kg-Oil (PPB)
ALPHA - BHC	--490--	250
GAMMA - BHC	ND	250
BETA - BHC	ND	250
HEPTACHLOR	ND	250
DELTA - BHC	ND	250
ALDRIN	ND	250
HEPTACHLOR EPOXIDE	ND	250
ENDOSULFAN I	ND	250
4,4'-DDE	ND	250
DIELDRIN	ND	250
ENDRIN	ND	250
4,4'-DDD	ND	250
ENDOSULFAN II	ND	250
4,4'-DDT	ND	250
ENDRIN ALDEHYDE	ND	250
ENDOSULFAN SULFATE	ND	250
METHOXYCHLOR	ND	2,500
TOXAPHENE	ND	2,500
CHLORDANE	ND	2,500

COMMENTS:

ANALYZED BY:

VL

J. Faulkner

REVIEWED BY:

KW

K. W. K. W.

GZA GEOENVIRONMENTAL, INC.
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164
(617) 969-0050

EPA 8080 ANALYSIS
PCB's/PESTICIDES SCREENING

JOB DESCRIPTION: TANK #5 - GROTON, MA
JOB #: 30894 DATE SAMPLED: 11/02/91
SAMPLE #: S-2 DATE TESTED: 11/08/91
LABORATORY #: 22393 - PCB/PEST DILUTION FACTOR: 50

PCB'S

8080 COMPOUNDS: POLYCHLORINATED BIPHENYLS	CONCENTRATION ug/kg-Oil (PPB)	DETECTION LIMIT ug/kg-Oil (PPB)
AROCLOR 1260	--650,000--	2,500
AROCLOR 1254	ND	2,500
AROCLOR 1248	ND	2,500
AROCLOR 1242/1016	ND	2,500
AROCLOR 1232	ND	2,500
AROCLOR 1221	ND	2,500

PESTICIDES

8080 COMPOUNDS: PESTICIDES	CONCENTRATION ug/kg-Oil (PPB)	DETECTION LIMIT ug/kg-Oil (PPB)
ALPHA - BHC	--2,600--	250
GAMMA - BHC	ND	250
BETA - BHC	ND	250
HEPTACHLOR	ND	250
DELTA - BHC	ND	250
ALDRIN	ND	250
HEPTACHLOR EPOXIDE	ND	250
ENDOSULFAN I	ND	250
4,4'-DDE	ND	250
DIELDRIN	ND	250
ENDRIN	ND	250
4,4'-DDD	ND	250
ENDOSULFAN II	ND	250
4,4'-DDT	ND	250
ENDRIN ALDEHYDE	ND	250
ENDOSULFAN SULFATE	ND	250
METHOXYCHLOR	ND	2,500
TOXAPHENE	ND	2,500
CHLORDANE	ND	2,500

COMMENTS:

ANALYZED BY:

VL

J. Faulstich

REVIEWED BY:

KW

K. W. K. W.

GZA GEOENVIRONMENTAL, INC.
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(617) 969-0050

EPA 8080 ANALYSIS
PCB's/PESTICIDES SCREENING

JOB DESCRIPTION: TANK #5 - GROTON, MA

JOB #: 30894

DATE SAMPLED: 11/02/91

SAMPLE #: S-2A

DATE TESTED: 11/08/91

LABORATORY #: 22394 - PCB/PEST

DILUTION FACTOR: 50

PCB'S

8080 COMPOUNDS: POLYCHLORINATED BIPHENYLS	CONCENTRATION ug/kg-Oil (PPB)	DETECTION LIMIT ug/kg-Oil (PPB)
AROCOR 1260	--160,000--	2,500
AROCOR 1254	ND	2,500
AROCOR 1248	ND	2,500
AROCOR 1242/1016	ND	2,500
AROCOR 1232	ND	2,500
AROCOR 1221	ND	2,500

PESTICIDES

8080 COMPOUNDS: PESTICIDES	CONCENTRATION ug/kg-Oil (PPB)	DETECTION LIMIT ug/kg-Oil (PPB)
ALPHA - BHC	ND	250
GAMMA - BHC	ND	250
BETA - BHC	ND	250
HEPTACHLOR	ND	250
DELTA - BHC	ND	250
ALDRIN	ND	250
HEPTACHLOR EPOXIDE	ND	250
ENDOSULFAN I	ND	250
4,4'-DDE	ND	250
DIELDRIN	ND	250
ENDRIN	ND	250
4,4'-DDD	ND	250
ENDOSULFAN II	ND	250
4,4'-DDT	ND	250
ENDRIN ALDEHYDE	ND	250
ENDOSULFAN SULFATE	ND	250
METHOXYCHLOR	ND	2,500
TOXAPHENE	ND	2,500
CHLORDANE	ND	2,500

COMMENTS:

ANALYZED BY:

VL

J. Faulkner

REVIEWED BY:

KW

K. Walsh

GZA GEOENVIRONMENTAL, INC.
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164
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EPA 8080 ANALYSIS
PCB's/PESTICIDES SCREENING

JOB DESCRIPTION: TANK #5 - GROTON, MA

JOB #: 30894

DATE SAMPLED: 11/02/91

SAMPLE #: GZ-1, S-3

DATE TESTED: 11/08/91

LABORATORY #: 22389 - PCB/PEST

DILUTION FACTOR: 0.1

PCB'S

8080 COMPOUNDS: POLYCHLORINATED BIPHENYLS	CONCENTRATION ug/kg-Soil (PPB)	DETECTION LIMIT ug/kg-Soil (PPB)
AROCLOR 1260	ND	5.0
AROCLOR 1254	ND	5.0
AROCLOR 1248	ND	5.0
AROCLOR 1242/1016	ND	5.0
AROCLOR 1232	ND	5.0
AROCLOR 1221	ND	5.0

PESTICIDES

8080 COMPOUNDS: PESTICIDES	CONCENTRATION ug/kg-Soil (PPB)	DETECTION LIMIT ug/kg-Soil (PPB)
ALPHA - BHC	--930--	0.5
GAMMA - BHC	ND	0.5
BETA - BHC	ND	0.5
HEPTACHLOR	ND	0.5
DELTA - BHC	--230--	0.5
ALDRIN	ND	0.5
HEPTACHLOR EPOXIDE	--240--	0.5
ENDOSULFAN I	ND	0.5
4,4'-DDE	ND	0.5
DIELDRIN	ND	0.5
ENDRIN	ND	0.5
4,4'-DDD	ND	0.5
ENDOSULFAN II	ND	0.5
4,4'-DDT	ND	0.5
ENDRIN ALDEHYDE	ND	0.5
ENDOSULFAN SULFATE	ND	0.5
METHOXYCHLOR	ND	5.0
TOXAPHENE	ND	5.0
CHLORDANE	ND	5.0

COMMENTS:

ANALYZED BY:

VL

J. Faulkner

REVIEWED BY:

KW

K. Walsh

GZA GEOENVIRONMENTAL, INC.
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164
(617) 969-0050

EPA 8080 ANALYSIS
PCB's/PESTICIDES SCREENING

JOB DESCRIPTION: TANK #5 - GROTON, MA
JOB #: 30894 DATE SAMPLED: 11/02/91
SAMPLE #: GZ-4, S-1 DATE TESTED: 11/08/91
LABORATORY #: 22390 - PCB/PEST DILUTION FACTOR: 0.1

PCB'S

8080 COMPOUNDS: POLYCHLORINATED BIPHENYLS	CONCENTRATION ug/kg-Soil (PPB)	DETECTION LIMIT ug/kg-Soil (PPB)
AROCOR 1260	--32--	5.0
AROCOR 1254	ND	5.0
AROCOR 1248	ND	5.0
AROCOR 1242/1016	ND	5.0
AROCOR 1232	ND	5.0
AROCOR 1221	ND	5.0

PESTICIDES

8080 COMPOUNDS: PESTICIDES	CONCENTRATION ug/kg-Soil (PPB)	DETECTION LIMIT ug/kg-Soil (PPB)
ALPHA - BHC	--530--	0.5
GAMMA - BHC	ND	0.5
BETA - BHC	--120--	0.5
HEPTACHLOR	ND	0.5
DELTA - BHC	ND	0.5
ALDRIN	ND	0.5
HEPTACHLOR EPOXIDE	--110--	0.5
ENDOSULFAN I	ND	0.5
4,4'-DDE	ND	0.5
DIELDRIN	ND	0.5
ENDRIN	ND	0.5
4,4'-DDD	ND	0.5
ENDOSULFAN II	ND	0.5
4,4'-DDT	ND	0.5
ENDRIN ALDEHYDE	ND	0.5
ENDOSULFAN SULFATE	ND	0.5
METHOXYCHLOR	ND	5.0
TOXAPHENE	ND	5.0
CHLORDANE	ND	5.0

COMMENTS:

ANALYZED BY:

VL

REVIEWED BY:

KW

D. Faulkner

K. Walsh

VOC ANALYSIS (EPA METHOD 8240)

GZA GEOENVIRONMENTAL, INC., ENVIRONMENTAL CHEMISTRY LABORATORY
320 NEEDHAM STREET, NEWTON UPPER FALLS, MA 02164 (617) 969-0050
MASSACHUSETTS LABORATORY I.D. NO. MA092

EPA METHOD 8240/8260 ANALYSIS FOR VOLATILE ORGANICS BY GC/MS

JOB DESCRIPTION: TANK #5 - GROTON, CT
JOB #: 30894
SAMPLE #: S-1a FLOATER
MATRIX: OIL
LABORATORY #: A9387

DATE SAMPLED: 11/02/91
DATE EXTRACTED: ----
DATE TESTED: 11/08/91
DILUTION FACTOR: 500

PRIORITY POLLUTANT LIST 8240 COMPOUNDS:	CONCENTRATION ug/l or ug/kg (PPB)	QUANTITATION LIMIT ug/l or ug/kg (PPB)
CHLOROMETHANE	ND	5,000
BROMOMETHANE	ND	5,000
VINYL CHLORIDE	ND	5,000
CHLOROETHANE	ND	5,000
METHYLENE CHLORIDE	--7,700--	5,000
1,1-DICHLOROETHENE	ND	2,500
1,1-DICHLOROETHANE	ND	2,500
TOTAL 1,2-DICHLOROETHENES	ND	2,500
CHLOROFORM	ND	2,500
1,2-DICHLOROETHANE	ND	2,500
1,1,1-TRICHLOROETHANE	ND	2,500
CARBON TETRACHLORIDE	ND	2,500
BROMODICHLOROMETHANE	ND	2,500
1,2-DICHLOROPROPANE	ND	2,500
TRANS 1,3-DICHLOROPROPENE	ND	2,500
TRICHLOROETHENE	ND	2,500
DIBROMOCHLOROMETHANE	ND	2,500
1,1,2-TRICHLOROETHANE	ND	2,500
BENZENE	ND	2,500
CIS 1,3-DICHLOROPROPENE	ND	2,500
BROMOFORM	ND	2,500
1,1,2,2-TETRACHLOROETHANE	ND	2,500
TETRACHLOROETHENE	--5,700--	2,500
TOLUENE	--8,600--	2,500
CHLOROBENZENE	ND	2,500
ETHYL BENZENE	--9,200--	2,500
1,2-DICHLOROBENZENE	ND	5,000
1,3-DICHLOROBENZENE	ND	5,000
1,4-DICHLOROBENZENE	ND	5,000

SEE PAGE 2 - FOR REMAINING COMPOUNDS

EPA METHOD 8240 ANALYSIS
FOR VOLATILE ORGANICS BY GC/MS

JOB DESCRIPTION: TANK #5 - GROTON, CT
 JOB #: 30894
 SAMPLE #: S-1a FLOATER
 MATRIX: OIL
 LABORATORY #: A9387

HAZARDOUS SUBSTANCE LIST 8240 COMPOUNDS	CONCENTRATION ug/l or ug/kg (PPB)	QUANTITATION LIMIT ug/l or ug/kg (PPB)
ACETONE	--26,000--	25,000
CARBON DISULFIDE	ND	2,500
2-BUTANONE (MEK)	--79,000--	50,000
VINYL ACETATE	ND	10,000
2-HEXANONE (MBK)	ND	10,000
4-METHYL-2-PENTANONE (MIBK)	ND	10,000
TOTAL XYLENES	--52,000--	2,500
STYRENE	ND	2,500

MISCELLANEOUS 8240 COMPOUNDS:	CONCENTRATION ug/l or ug/kg (PPB)	QUANTITATION LIMIT ug/l or ug/kg (PPB)
METHYL-t-BUTYL ETHER	ND	5,000
TRICHLOROFLUOROMETHANE	ND	10,000

SURROGATES	% RECOVERY
1,2-DICHLOROETHANE - D4	104
TOLUENE - D8	91.5
4-BROMOFLUOROBENZENE	97.4

COMMENTS:

ANALYZED BY:

Wong

REVIEWED BY:

K Walsh

EPA METHOD 8240\8260 ANALYSIS FOR VOLATILE ORGANICS BY GC/MS

OVERVIEW

EPA Method 8240\8260 is a purge and trap gas chromatographic method for the identification and quantification of volatile organic compounds in aqueous and solid samples. Purge and trap is a dynamic headspace technique where volatiles in an aqueous/solid sample are completely stripped from the aqueous/solid phase to vapor phase. The volatiles from the depleted sample are collected on an absorbent trap, thermally desorbed to a gas chromatograph for separation using a capillary column, and routed to a mass spectrometer.

METHODOLOGY

A Tekmar Model LSC-2000 Liquid Sample Concentrator is used in conjunction with a Tekmar Model ALS2016 Automatic Laboratory Sampler to purge volatile compounds by bubbling helium gas through a 5 ml aqueous matrix and passing the vapor through a tenax/silica gel sorbent trap. Aqueous samples are introduced directly into the sample sparging apparatus. Solid samples are prepared using two methods: a high level and a low level method. The high level method is a solvent extraction of the sample using capillary grade methanol of which an aliquot is spiked into reagent water and subsequently treated as an aqueous sample. The low level method involves the transfer of a five gram solid subsample to the sparging device, the addition of reagent water to the sample, and utilizing a sample heater to purge volatile components. The purgeable compounds retained on the tenax/silica gel trap are then thermally desorbed and passed through a heated line into the gas chromatograph. GZA performs this method on a Hewlett-Packard UP 5890A Gas Chromatograph and a Hewlett Packard Model 5970B Mass Selective Detector which is interfaced to a Hewlett-Packard HP 1000 RTE A Series Micro 24 System with Aquarius data acquisition software. The information for the report is entered manually onto a Lotus Symphony spreadsheet. Calibration and quality control are performed in accordance with the protocols established by the EPA and Massachusetts DEP published in the references cited below.

REPORT FORMAT

The quantitation limit is stated for every report and is adjusted when dilutions are made to bring sample response data within the calibrated range of the method. Concentrations less than the quantitation limit may be identified as Beneath Method Quantitation Limit (BMQL).

DISCLAIMER

Identities and concentrations of purgeable organic compounds by this dynamic headspace technique are subject to limitations inherent to these methods.

LABORATORY CONTACT PERSON:

Edward W. Pickering, Manager
Environmental Chemistry Laboratory
GZA GeoEnvironmental, Inc.
Massachusetts Laboratory I.D. No. MA 092
Phone #: (617) 969-0050 x169

REFERENCES

Commonwealth of Massachusetts DEP, "Minimum Standards for Analytical Data for Remedial Response Actions Under M.G.L.c. 21E", Policy #WSC-89-004 (1990).

McNally, M.E. and R.L. Grob, "A Review: Current Applications of Static and Dynamic Headspace Analysis: Part One: Environmental Applications", Am. Lab. 20 (1) 20-33, (1985).

U.S. EPA, "Handbook for Analytical Quality Control in Water and Waste Water Laboratories", EP-600/4-79-1019 (1979).

U.S. EPA "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", Appendix A. 40CFR Part 136, Federal Register, Vol. 49, No. 209. Method 624-Purgeables (1984).

U.S. EPA, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, Volume 1B, Update Method 8240: GC/MS for Volatile Organics. Update Method 8260: Gas Chromatography/Mass Spectrometry for Volatile Organics: Capillary Column Technique. Method 5030: Purge and Trap. May 1989.

9/23/91 DM

METALS



R.I. Analytical

Specialists in Environmental Services

CERTIFICATE OF ANALYSIS

GZA/GEO Environmental
Attn: Mr. William Ladd
140 Broadway
Providence, RI 02903

DATE RECEIVED: 11/05/91
DATE REPORTED: 12/02/91
P.O. #: 34361
INVOICE #: D5584

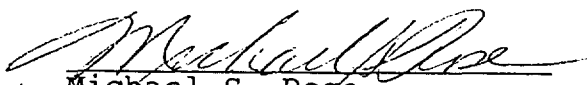
SAMPLE DESCRIPTION: Two (2) oil sludge samples labelled
Tank #5, Groton, CT

Subject samples have been analyzed by our laboratory with
the attached results.

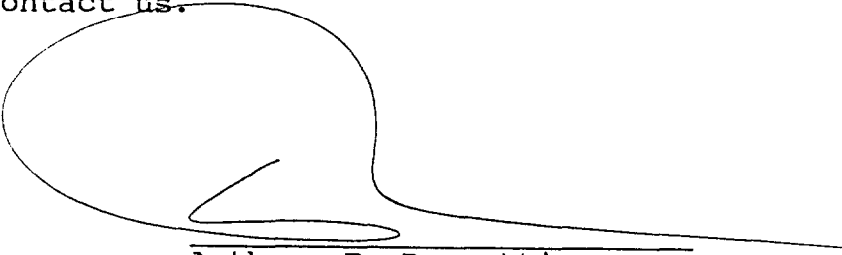
Reference: Test Methods for Evaluating Solid Waste, Physical/
Chemical Methods, U.S. EPA, SW-846, July 1982,
second edition.

If you have any question regarding this work or if we may be
of further assistance, please contact us.

Approved by:


Michael S. Rose
Laboratory Manager

djr


Anthony E. Perrotti
President

CERTIFICATE OF ANALYSIS

GZA/GEO Environmental

Date Received: 11/05/91

Date Reported: 12/02/91

Invoice #: D5584

P.O. #:

PARAMETER	S-1 (SLUDGE)	S-2 (SLUDGE)
Total Metals:		
Antimony	3.84 mg/kg	4.67 mg/kg
Arsenic	0.54 "	0.76 "
Beryllium	<1.00 "	141 "
Cadmium	7.14 "	6.67 "
Chromium	123 "	103 "
Copper	868 "	647 "
Lead	217 "	275 "
Mercury	1.00 "	1.00 "
Nickel	75.0 "	70.5 "
Selenium	<0.50 "	<0.50 "
Silver	3.57 "	3.81 "
Thallium	<0.50 "	<0.50 "
Zinc	9.82 "	894 "

RI ANALYTICAL LABORATORIES, INC.

CHAIN OF CUSTODY FORMS

157 1-3

[illegible]

156 23-25

PINK COPY - Lab Files

[illegible]